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The Effect of Creativity, Response Mode, and Subject Matter Familiarity on Achievement from Programmed Instruction.

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The purpose of this study was to investigate the relation in programed instruction between creativity, response mode, and familiarity of the material to the subject. Creativity was defined by scores on the Remote Associations Test. The two response modes were constructing responses and simply reading them. The material, drawn from a long program on heart disease, was divided into relatively familiar and technical sections. One hundred subjects, divided into two groups judged high and low in creativity, took pretests (to insure that familiar section was indeed familiar), versions of the program itself, and posttest (to determine how successful the programed instruction had been. The highly creative group was found to be more successful on all versions of the program, but a high correlation between creativity scores and SAT (Scholastic Aptitude Tests) verbal scores suggested that the ability originally determined was most aptly termed verbal ability than creativity. In regard to response modes, constructing responses was found to be more successful than reading responses only for technical material. The "blackout ratio," the repetitiousness of designed response, was found not to be correlated significantly with successful instruction. (JS)

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The Effect of Creativity, Response Mode, and Subject Matter Familiarity on Achievement from Programmed Instruction

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November, 1968

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SUMMARY

The purpose of this study was to investigate the interaction between creativity, response mode to programmed instruction, and the degree to which the material was familiar to the subject. It was reasoned that the conventional reinforcement present in a linear program requiring constructed responses would not facilitate the achievement of creative subjects compared to a less creative group. Furthermore, it was predicted that constructing responses would lead to higher achievement on technical, unfamiliar materials, but not on familiar materials, than reading the program cast in the form of completed statements.

This study consisted of a 2 x 2 x 3 ANOVA design. The first classification comprised two levels of creativity determined by scores on the Remote Associates Test. The second level consisted of two response modes: constructed response and reading the material cast in the form of completed sentences. The third level was made up of three measures of S's (N = 100) achievement on familiar material, technical material requiring a verbal response, and technical material requiring a pictorial response. The technical part of the instructional material consisted of a revised version of a linear program dealing with the diagnosis of myocardial infarction. The familiar material consisted of 54 introductory frames dealing with the incidence and risk of contracting heart disease.

The results indicated that, contrary to prediction, the achievement of the high creativity group was significantly above that of the low group on all kinds of subject matter. The correlation of .56 between RAT and SAT-Verbal may well have accounted for this superiority. The predicted interaction between response mode and familiarity of subject matter was obtained. There were no significant differences between the constructed response and reading group on the familiar material, though these groups did differ on technical material requiring verbal response ($p < .05$) and on material requiring a pictorial response ($p < .01$).

These findings confirm, in one investigation, that discrepant findings in prior research on response mode may well be attributed to the degree to which the subject matter was familiar to the Ss. Furthermore, the data suggest that blackout ratio of a program may be less important than the familiarity of the subject matter in predicting which response mode is likely to lead to the highest achievement.

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CHAPTER I. INTRODUCTION

The renewed interest in technological aids to education has stimulated a great deal of theoretical and research activity in programmed instruction (PI). In the article which revived interest in teaching machines, Skinner (1954) noted the adaptability of programmed materials to individual differences with respect to the pace at which a pupil learns. It was emphasized that no longer would faster pupils have to be subjected to boredom or tension resulting from a classroom pace which was either too slow or too fast for their abilities and interests. Implicit in such anticipations was the notion that achievement via PI was likely to vary with situational and individual differences. In view of these expectations it is surprising to see that after more than a dozen years of investigation there is a marked scarcity of research regarding the effect of individual differences on achievement from programmed materials. The clarification of this problem was the major purpose of the present report.

This study sought to investigate several aspects of the relationship between PI and other variables: (1) the extent to which differences in associative creativity affected achievement from PI, (2) the degree to which familiarity with the subject matter affected achievement under different modes of responding to PI, and finally, (3) whether the variables mentioned above interacted with one another.

Theoretical and practical grounds suggest that variables other than individual differences or response mode are of importance in achievement. Anderson (1967) reports a number of studies reporting an interaction between achievement and the degree to which the content is familiar to subjects. If familiarity with subject matter by itself has an effect on achievement, studying the degree to which subject matter interacts with individual difference and response variables would clarify the nature of learning from programmed materials, and human learning in general. The study of this kind of an interaction is advocated by Cronbach (1967) in order to provide the research clarification required for the ultimate implementation of a truly individualized instruction.

Review of the Literature

The major thrust of large numbers of early studies of PI concerned two issues: (1) the effect of presenting a program in a teaching machine compared to presenting the same material in one of a variety of booklet or index card formats, and (2) the effect of the response mode on achievement via programmed materials. The first issues were disposed of with relative dispatch when Goldstein and Gotkin (1961) published a review of a number of studies which uniformly demonstrated that there was no difference between presenting programmed materials in or outside of a machine. The issue of response mode was not so easily dismissed and has generated a considerable body of research.

Response Mode

Anderson (1967) cites nine studies focusing on the manner of responding to an instructional program. Typical of the procedures of many of these investigations was a study by Tobias and Weiner (1963). An instructional program was administered to three groups in three different ways. The constructed response (CR) group answered each frame in the manner advocated by Skinner (1958), and then checked the accuracy of their responses. The covert response group took the same program, but rather than overtly constructing their responses, they were instructed to "think the answer" prior to checking it. The third group took a version of the same program with the response blanks filled in. The findings of this study indicated that there were no significant differences in achievement among the groups on an immediate post-test, a delayed post-test, nor in the attitudes of Ss towards the content and format of the program. The finding of no difference among response modes was a "typical finding" of most studies dealing with this issue (Anderson, 1967, p. 139). In view of the fact that the occurrence of an overt response, and the presence of feedback, were fairly central attributes of PI, these findings constituted something of a dilemma to advocates of programmed learning. An explanation for the findings of no difference among response modes was offered in a paper by Kemp and Holland (1966). These writers demonstrated that the problem with many of the studies reporting no differences among response modes could be attributed to the poor quality of the programs employed in those investigations.

In a series of papers by Holland (1967), Holland and Kemp (1965), and Kemp and Holland (1966) the "blackout ratio" was introduced as a measure of the adequacy of an instructional program. The ratio consists simply of the number of words in a program that can be eliminated, or blacked out, without affecting the program's error rate. Clearly this is a useful measure of the amount of redundancy in a program, or, as Holland maintains, the degree to which material is actually programmed, i.e., the degree to which the response is contingent upon material introduced in a frame. Kemp and Holland (1966) blacked out the first 50 frames of 12 programs utilized in different research studies. The results indicated that the programs with the lowest blackout ratios (11.1 - 25.4%) had been utilized in studies with findings favorable to the CR mode. The eight other programs with blackout ratios ranging from 31% to 74.6% had all found no difference between CR and other response modes. These reports clearly suggested that the failure to find differences among response modes could be attributed to the high blackout ratios of the programs employed. Prior to the publication of the studies dealing with the blackout ratio, a number of other investigations appeared that pointed to the importance of the program content as a variable in the research on achievement from programmed material.

Subject Matter Variables

Cummings and Goldstein (1962) studied the effects of overt versus covert responding to a program dealing with the technical aspects of the diagnosis of damage to the heart as detected by the ECG. Their Ss were required to differentiate between normal and diseased ECG tracings, degrees of damage to the heart, graphic representation of that damage, and similar technical subject matter. As predicted, highly significant differences in favor of the CR group were found for Ss' responses on pictorial material, but, contrary to prediction, the differences for the verbal material were also significant, though of lower magnitude. The differences between response modes were attributed by the authors to the technical nature of the subject matter.

In three studies Williams (1963, 1965, 1966) found general support for the superiority of the CR mode. The first study (1963) demonstrated that CR and multiple choice response groups achieved more than two groups who read the program with, or without, emphasis provided by underlining. On technical or novel items introduced by the program the CR group achieved more than the multiple choice group, though not on items involving familiar vocabulary. In a second study Williams (1965) confirmed these findings with a different program, and sample. In the latter study it was also found that differences in response mode were manifested only on a CR criterion test, and not on multiple choice test items.

Other studies have also found evidence of an interaction between response mode and program content. Tuel and Metfessel (1965) found overt responding more effective for the mastery of very difficult material as measured by an immediate recall test. The difference, however, disappeared on delayed recall. The latter investigation differed from those cited above in that a program pairing foreign and English words was employed, rather than connected discourse material. A suggestion that difficult material was more effectively learned by CR was also found in Goldbeck and Campbell's data (1962).

Individual Difference Variables

A relatively small number of investigations have sought to relate achievement via PI to individual difference variables. One area in which a group of studies has been reported has to do with the relationship between anxiety and achievement from programmed materials. The popularity of this area can probably be attributed to the fact that there is a compelling rationale for the interaction between achievement from programmed materials and anxiety, suggesting that anxious Ss ought to profit more from PI than from other materials in view of the high degree of structure imposed by programming.

Anxiety and PI. Kight and Sassenrath (1966) found that anxious Ss, defined by scores on the Test Anxiety Questionnaire, worked faster and made fewer program errors on a linear program dealing with test construction than less anxious Ss. There were, however, no achievement differences between the anxiety groups. O'Reilly and Ripple (1967) found a correlation of -.53 between achievement on a linear program dealing with longitude and latitude and test anxiety as measured by Sarason's Test Anxiety Scale for Children (TASC). Sixth grade youngsters served as Ss in this study. In a stepwise multiple regression analysis this correlation dropped to a much less impressive beta of -.125 which, while still significant, accounted for a small percentage of the achievement variance.

Flynn and Morgan (1966) investigated the effects of anxiety on achievement in an introductory unit in vector geometry. Elementary school Ss were separated into low, medium, and high anxiety groups on the basis of a test anxiety questionnaire. One set of Ss learned the material from an instructional program, while another group of Ss were instructed by teachers. "Provisions were made to insure uniformity of subject matter content for all six classes" (p. 260). A 2x3 analysis of variance revealed no significant main effects; the interaction was also not significant.

In the investigations cited so far response mode to the learning materials was not varied. Lache (1967) utilized four response modes; CR, optional CR, covert response, and a reading condition. He found no achievement differences among the response modes. Neither were any differences found among three anxiety groups established on the basis of eighth grade Ss' test anxiety scores. The anxiety and response mode variables were not found to interact. Tobias and

Williamson (1968) also found no difference between anxiety groups, or among response modes in a 2x3 factorial design involving two levels of anxiety, determined on the basis of scores on the TMAS, and three response modes. A CR mode, CR without reinforcement, and a reading condition were utilized in this experiment. Tobias and Williamson (1968) questioned the utility of research designs in which the anxiety variable is assigned on the basis of a test score, since such procedures can only assume that anxiety was actually operating within the experimental situation. These investigators suggest that anxiety be experimentally varied in future research.

Ability and PI. Another individual difference variable which has been studied in a number of PI studies is ability. Campbell (1963) studied the effectiveness of a bypass (branching) program compared to two versions of a linear program as a function of differences in student mathematical ability (the subject of the program). He found no evidence of an interaction between these variables, the most able students learned most--under all conditions, and the less able students learned least--under all conditions.

Williams (1963, 1965) also found that high ability students learned more than low ability groups when post-test data were used as criteria. In the later investigation (1965) she found that high ability students also gained more than low ability students. In general, however, she found that response mode did not interact with aptitude. The one exception to this generalization may probably be attributed to a feature unique to the design of the experiment (1965, p. 116). Oppenheim (1965) also reports finding no evidence of an interaction between response mode and aptitude. In that investigation students with high and low SAT-Verbal scores responded to a program in two reinforced conditions (overt and covert responding), and by reading the program without receiving any reinforcement. Oppenheim found no difference between the response modes on either immediate or delayed recall, nor was there evidence for an interaction between ability and response mode.

Wittrock (1963), on the other hand, did find evidence for an interaction between overt responding and mental ability (significant at the .05 level). Children with IQ's below 120 learned difficult concepts more readily by making overt responses compared to children with IQ's over 120. The generality of this finding may well be limited by the fact that the overt condition required Ss to respond by speaking out loud, a relatively rare feature in programs in general use. Finally, significance at the .05 level suggests that the findings need to be replicated before one can view them as challenging the trend suggested by the other findings.

Correlations between Other Variables and PI. Finally, there are a number of investigations studying the relationship between a variety of individual difference variables and PI. Doty and Doty (1964) examined the relationship between achievement on an instructional program and a series of college student characteristics. They found that achievement was positively correlated with the students' grade point average, and negatively correlated with social need (measured by the Sociability Scale of the Guilford-Zimmerman), and creativity (measured by some of Getzel's and Jackson's (1962) tests). The program was completed by Ss outside of class.

Lublin (1965) studied the effects of schedules of reinforcement on achievement via programmed instruction. Among the findings of particular interest for present purposes was the absence of an interaction between schedule of reinforcement and scholastic aptitude, confirming the bulk of the findings reported. More interesting from the present point of view, however, was the finding that Ss having a low need for autonomy, as measured by the Edwards Personality Preference Schedule, achieved significantly more than Ss with a high need for autonomy. Data for the interaction between autonomy needs and other variables were not reported.

Gotkin and Massa (1963) also studied the relationship between creativity, measured by the Torrance battery of tests, and achievement from programmed instruction in a group of bright elementary school fourth and fifth graders. These investigators duplicated the Dotys' finding of a small negative relationship between creativity and achievement from programmed materials--the correlations ranged from -.34 to -.29. Again, all Ss responded to the program in the same way, precluding any study of the interaction between individual difference variables and program variables.

Stone (1965) studied the effects of learner characteristics on performance from PI. He found differences with respect to the amount of time taken to learn the material in favor of the PI group, though not with respect to achievement. Stone also found that PI was not more beneficial for people with poor study habits than those with good study habits, and that attitudes toward programmed instruction did not interact with achievement.

Fiks (1964) was able to gather data on a group of Ss quite different from those usually participating in PI research. He utilized 115 Ss at the 1961 Indiana State Fair who volunteered to take several brief programs of 20-24 frames. He found that Ss with little schooling had a more positive attitude towards materials high in confirmation than those with more formal education. He also found a tendency for rural Ss to prefer the covert response mode, whereas urban Ss preferred the CR mode.

O'Reilly and Ripple (1967) found the following correlations between achievement on a program and a variety of measures: Verbal IQ r = .74, imagination r = .43, fluency r = .38, originality r = .21, flexibility r = .21. While each of these correlations was significant, stepwise multiple regression analysis indicated that little variance was added to the equation by any of these variables once a pre-test and verbal IQ were entered into the equation.

These studies offer little basis for generalizing about the relationship between individual difference variables and PI. Since different programs were employed, and different tests administered to Ss, the generality of much of this evidence is open to question. Where data regarding creativity was amassed the correlations were low and significant, and suggested that a negative relationship existed between creative ability and achievement from PI.

Creativity

In any new area of investigation, measurement is a paramount problem. Creativity is no exception to this rule. McNemar (1964) has pointed to some of the dangers involved in measuring creativity. Most important among these is the absence of sound criterion evidence for many creativity measures. The difficulty of obtaining consensual validation for a phenomenon as ephemeral as creativity exacerbates this problem. The available data indicate that the instrument to be used in this study surmounts these problems.

Mednick and his colleagues have published a series of papers dealing with the associative basis of the creative process. The process is viewed as involving the combination of associative elements, which are mutually remote from each other, in the sense of being infrequently associated with one another, into a new combination (Mednick, 1962). The operational measure employed in these investigations has been the Remote Associates Test (RAT). The RAT is composed of a series of items of three words each. The words come from mutually distant associative clusters, and the S's task is to provide mediating links between them. For example, (Mednick, 1962, p. 227):

wheel electric high

The subject is required to find a fourth word which could serve as a connecting link to each of the three words given. In the example cited the answer is: chair or wire. Other examples are:

surprise line birthday
railroad girl class

The answers to these problems are party for the first item, and working for the second. Evidence regarding the construct validity of the RAT, and its reliability will be presented in the section dealing with materials.

A study by Houston and Mednick (1963) is crucial to the rationale of the present study. These investigators found that *S*s scoring high on the RAT differed significantly from low scorers in their response to associations with a high or a low frequency of occurrence. In an operant conditioning situation, two groups of high and low scorers on the RAT were asked to say either a noun or an adjective. For every choice of a noun the experimenter (*E*) responded with a novel association to it (e.g., father: eggbeater), but for a choice of adjective the *E* responded with a conventional association (e.g., black: white). Two control groups were given conventional associations to both nouns and adjectives. The results indicated that high RAT scorers increased their use of nouns--for which they had received novel responses by *E*. Low RAT scorers, however, used fewer nouns, and increased their use of adjectives--for which they had received conventional high frequency responses. This finding suggested that conventional high frequency associations have marked reinforcing value for low RAT scorers, but not for high scorers.

The use of the concept of associative remoteness in a study of PI has a number of advantages. First among these is the presence of the RAT as an operational definition of this construct. The construct validity evidence relating this test to the associative process (Mednick, Mednick, and Jung, 1964; Mednick, Mednick, and Mednick, 1963), and the fact that it is theoretically cast in an associative framework (Mednick, 1962) has obvious advantages for a study relating associative ability to PI. Finally, Houston and Mednick's finding (1963) relating RAT score to the reinforcing value of low and high frequency reinforcers has clearcut pertinence to PI. One wonders how reinforcing a group of high RAT scorers would find the reinforcement offered in the conventional instructional program whose frequency of occurrence is 90%. Clearly, such a reinforcement is highly conventional, and while it may well have high reinforcing value for low scorers on the RAT, it should have little reinforcing value for high scorers.

Summary

The review of the research leads to the following tentative conclusions. Recent evidence has suggested that the CR mode is superior to other response modes for technical or novel material, though not for familiar subject matter. Furthermore, the degree to which the response to a frame is contingent upon material presented earlier in the frame is of some importance in demonstrating the superiority of one response mode over another; i.e., the degree to which the blackout ratio of the material is low. By and large, for programs dealing with material which is either novel or technical, or for programs whose blackout ratio is low, constructing responses results in higher achievement than thinking them, or reading them. An interaction between response mode and familiarity of subject matter is thus predicted.

Research on the interaction between PI variables and individual difference variables is inconclusive. There is some dispute regarding the effect of intelligence on achievement for programmed materials, though by and large the generalization that brighter students learn more from programmed materials than do duller students appears justified. Research relating variables other than intelligence to achievement from programmed instruction is both scarce and predominantly correlational. Low correlations have been reported for a number of cognitive and personality variables and achievement from PI. Few studies have systematically varied individual difference variables and programmed instructional variables at the same time. What evidence there is relating individual difference variables to PI is based on descriptibe data obtained by giving Ss a program and relating their performance to a variety of tests. Clearly such descriptive procedures leave a great deal to be desired with respect to establishing an interaction between programmed instruction and other variables.

The research on creativity reviewed for this report indicates that the measurement of creativity is an area of considerable dispute. Low correlations between different tests of creativity are reported, and the evidence regarding the correlation between creativity and intelligence is confusing. Typically, creativity tests have little more than face validity.

The theoretical basis for conceptualizing creativity within an associative framework offered by Mednick and his associates has distinct advantages over other approaches to creativity. Among these is the fact that the conception of creativity is related to a theoretical approach to learning. The further advantage of this framework is the fact that it is operationally defined by a test, the RAT.

The test has the advantage of possessing clearcut construct validity. Furthermore, studies relating this test to external criteria have provided strong positive evidence of its validity.

Of special significance are the findings relating the RAT to the low reinforcing value of frequently occurring reinforcers for high scorers on the RAT, with converse expectations for low scorers. Clearly, on familiar programmed material, where a particular reinforcer appears in excess of 90% of the time, the high RAT scorer should not find this kind of reinforcement especially facilitating, compared to low scoring _S_s on the RAT. On technical material where the learner has fewer of the relevant responses, and the frequency of appearance of the reinforcer is, therefore, lower, both the high and the low RAT scorer ought to find the reinforcement offered in the conventional CR program beneficial to his learning. An interaction between response mode to PI and RAT score and familiarity of subject matter is thus predicted.

Hypotheses

1. On familiar material _S_s scoring low on the RAT will achieve more, and have more favorable attitudes to the program, by constructing their response to a program, than will high scorers.

2. Subjects constructing their responses to a program will achieve more, and have more favorable attitudes to the program, than those reading the program cast in the form of completed sentences on technical subject matter.

3. On familiar material there will be no difference between _S_s constructing their responses, and those reading the program cast in the form of completed sentences.

CHAPTER II. METHOD

The overall design of this experiment consisted of a 2x2 factorial study with a third level consisting of three repeated measures on each subject. The first variable consisted of two groups judged to be high and low in creativity as determined by their scores on the RAT. Within each group S̲s were randomly assigned to one of two treatment conditions: a CR group and a reading group. The treatments defined the second level in this study. The instructional program and post-test used in this project were subdivided into three sections: The first part consisted of material widely reported in the mass media with which S̲s were expected to have previous familiarity. The second section of the program dealt with technical subject matter to which S̲s had not been previously exposed and required both verbal and pictorial responses, that is, the answers consisted of either a word or a drawing. These three types of content present both in the program and the post-test defined the three repeated measures of the third level.

Materials Developed

The materials developed for this project included the following: an instructional program, pre- and post-tests for the program, and a scale intended to measure attitudes toward the format and content of the learning material. The steps in the development of each of these, together with reliability data, where appropriate, will be discussed in this section.

The Instructional Program

The learning materials employed in this study had to meet two contradictory criteria. Some parts of the material had to be sufficiently technical and uncommon so as to make it unlikely that the average college student knew much about the subject matter in advance of taking the program. At the same time another part of the program had to be sufficiently familiar to the student to test the hypothesis involving learning of familiar subject matter. A survey of programs indicated that no single program met these criteria. Consequently, a modified version of The Diagnosis of Myocardial Infarction (Mechner, undated) was employed for the technical part of the learning material. This program has been previously used by Cummings and Goldstein (1962), and by Oppenheim (1965), and was found to have a low blackout ratio by Holland (1967). A set of frames dealing with the incidence and risk of contracting heart disease was newly prepared for this project to serve as the non-technical, familiar part of the learning material.

The Diagnosis of Myocardial Infarction. This program was a 117 frame linear program dealing with various kinds of damage to the heart, their seriousness and reversibility, and the diagnostic significance of ECG tracings taken from the fifth precordial lead. Preliminary tryouts of the existing program on five Ss indicated that there were a number of inconsistencies, and a somewhat irregular progression at various points in the program. Difficulties with the program were also suggested by the extremely high error rate (33%) reported by Oppenheim. Consequently, it became clear that this program had to be partially rewritten and reorganized prior to its use in the present study.

The familiar, or non-technical part of the program had to meet three criteria: (1) the subject matter had to articulate with the technical part of the program in such a fashion that the final material emerged as one coherent program, (2) the material in this section of the program had to be such that the typical undergraduate student was likely to have had prior exposure to most of the terms, concepts, and facts covered, and (3) despite the lack of novelty, the program had to teach the student something he did not know before.

In view of the fact that the technical part of the program dealt with various aspects of the diagnosis of heart disease, it seemed appropriate for the familiar part of the program to deal with the same area. The final content of the familiar part of the program dealt with the following material: (1) the prevalence and incidence of heart disease, (2) the role of various risk factors, such as age, smoking, and cholesterol in increasing the probability of contracting heart disease, (3) the definition of what constitutes heart disease, and, finally, (4) an elementary conception was presented regarding the physical factors in heart disease. Terms such as cholesterol, the difference between incidence and prevalence, strain, and blockage were utilized. The familiar material comprised frames 1-54 of the final program. The transition to the technical program was accomplished in frame 55 where risk factors are related to myocardial infarction. The complete program is reproduced in its entirety in Appendix D.

The final program consisted of a total of 143 frames, 54 familiar and 89 technical, requiring a total of 233 responses. The familiar program required 69 responses, and the technical section 173 responses. Of the 173 technical responses 120 were verbal and 53 required a drawing, or pictorial response. In turn, the pictorial responses were made up of 33 answers involving drawings of ECG tracings and 20 pictorial representations of damage to the heart muscle.

Development of the new program, consisting of initial tryout of the familiar material and revision of the technical part of the program, proceeded in two stages. In the initial phase Xerox copies of the first draft of the material were given to a total of fifteen subjects. The opinions of Ss were solicited regarding various points in the program, and not infrequently the program was modified according to their suggestions. In view of the fact that the program was continually changing at this stage, no formal error rates were computed for this phase of the research.

A reading version of the program was then prepared. This version of the program presented exactly the same subject matter as in the constructed response version using the same frame by frame structure, without requiring Ss to make any overt responses. Wherever possible, response blanks were filled in and interrogative frames were changed to declarative sentences. On those frames where a drawing response was required in the constructed response version, the reading version depicted the completed drawing. Changes in wording from the constructed response version were minimized as far as possible, the criterion for the addition of a word or phrase being the necessity of making the frame intelligible.

The basic format of the program book was the same for both versions of the program. Each page was divided into three sections, the topmost section containing the familiar part of the program in frames 1 through 54 on consecutive pages. The middle section contained frames 55 through 108, and the bottom section contained frames 109 through 143. The format of the constructed response version also contained a left-hand margin in which the confirmation for the preceding frame was placed. For both versions of the program, the format required that S turn the page to get to the next frame. Each version of the program was 54 pages long.

The second phase of revisions of both versions of the program occurred after the completion of the pilot study. In the pilot study a total of 20 Ss were run on the materials, half on the reading and the other half on the CR version. The following error rates were determined for the 10 Ss taking the CR version: 2% for the familiar materials, and 15% for the technical part of the subject matter. Final revisions were then made to iron out remaining inconsistencies and to clarify ambiguities as determined by Ss' performance and comments.

Post-test

A final test requiring constructed responses was developed in order to assess what Ss had learned from the program. Also a pre-test for the familiar part of the program was required since, by definition, this material was not new to subjects. The tests were developed by classifying the various categories of subject matter covered by the program, e.g., drawing, text, etc., determining the weights each of these categories had in the program, and then assigning a similar weight to these areas on the test. The test for the technical part of the program was revised from the material employed by Cummings and Goldstein (1962), and the test for the familiar material was newly developed for this project. After the pilot study the tests were revised in accordance with the results of an item analysis.

The final test consisted of three subtests: the subtest for familiar material, alpha reliability (Cronbach, 1951) of .66; the subtest for pictorial material, alpha reliability of .86; and the subtest for technical material requiring textual responses, alpha reliability of .85. The alpha reliability of the whole test was .82. The reliability data was based on a total N of 114.

The testing of Ss required two sessions. Since a median split had to be conducted on Ss' RAT scores (see procedure section), and in order to maintain the longest interval possible between the pre-test and post-test, the pre-test was administered to all Ss during the first of two sessions. Since many Ss were thus pre-tested prior to the completion of the pilot study and the revisions made consequent to that study, all Ss in this study received the preliminary version of the test on the familiar part of the program as a pre-test. This test was somewhat different from the final version of the post-test and the alpha reliability of this test was .68. The pre- and post-tests appear in Appendix B.

Post-test and Program Scoring

Most of the verbal responses to both the program and post-test could easily be scored right or wrong. The interscorer reliability coefficients between any two scores was never lower than .90 for the total test. It quickly became clear, however, that the many tracing responses on both the program and the post-test could not be scored on a right or wrong basis. A drawing of an ECG tracing could be correct in most respects, yet deviate from the standard in some minor detail. Some of the subtleties of the degree to which Ss understood all relevant aspects of the subject matter could well reveal themselves in minor deviations from the standard. These considerations led to the adoption of a point system in scoring the correctness of tracings. The scoring scheme for the tracings was adapted from Oppenheim (1965).

Typically eight separate aspects of each tracing were evaluated independently with some criteria receiving half-credit. Each component had a value of one point and the score for any given tracing was a straightforward sum, without differential weighting, of the components. The typical maximum score for a tracing was eight points. The complete list of these criteria is given in Appendix B. Because of the complexity of the scoring scheme and its importance in evaluating achievement on the technical part of the program, the tracings were scored for each individual receiving the CR version, by two scorers working independently. A final score for each tracing was arrived at by reconciling differences between the scorers. If the difference was irreconcilable, the mean of the two scores was assigned. All ECG tracing responses were scored in this manner for all Ss in the study. Interscorer reliability for tracings was determined by computing the coefficient of concordance (Siegel, 1956) for three cases drawn from the pilot study. The values of W ranged from .78 to .98 for the scoring of tracings alone on the post-test, by different scorers. On the program a W of .98 was obtained for the tracing scores.

Attitude Scales

Two sets of attitude scales were developed for this project. The specific attitude scales were designed to measure S's feelings about the format and content of the learning material to which he was exposed. The second set of attitude scales was designed to tap the Ss' attitudes towards a variety of instructional media and were similar to those used in previous research (Tobias, 1963, 1966, 1968).

Specific Attitude Scales. The specific attitude scale consisted of a sixteen-item Likert-type scale. Each item had four choices. The first six items concerned Ss' attitudes towards the format of the material. The next four items related to the material covered in the non-technical part of the program. The last six items related to material covered in the technical part of the program, i.e., the myocardial infarction portion of the programmed materials. The alpha reliability of the total scale was .88. The reliability of the first six items, the portion of the scale relating to attitudes concerning the programmed format, was .88. The alpha reliability of the other two subscales were .86 for the attitudes toward the non-technical material, and .88 for the technical material.

A copy of the specific attitude scales appears in Appendix C. Subjects recorded their answers to the scale on an IBM 1230 answer sheet.

General Attitude Scales. Each subject was asked to rate his attitudes towards twenty terms describing a variety of educational media. The terms and the sequence in which they appeared are given in Table 1 below.

Table 1. Attitude Terms

Educational Television	Workbook
Audio-Visual Education	Programmed Test
Filmstrips	Self Instructional Program
Computer Assisted Instruction	Flashcard
Study Guide	Exercise Book
Educational Film	Tutor Text
Programmed Self Study	Automated Instruction
Teaching Machine	T.V. Tutor
Textbook	Educational Technology
Mechanized Tutor	Programmed Instruction

The terms were ordered into a sequence by means of a table of random numbers. Once the sequence was established the booklets were collated by beginning with a different term in each booklet. This procedure varied the order of appearance of each term within the randomly established sequence. Ss were instructed to rate their attitudes towards all terms according to their feelings about them, even if a particular term appeared unfamiliar.

The scales on which each term was rated were drawn from the semantic differential (Osgood, et al, 1957). Each of the scales had factor loadings of .85 and above on the evaluative factor, and minor loadings on other factors. Each term appeared at the top of the page succeeded by the following semantic differential scales: Good-Bad, Worthless-Valuable, Fair-Unfair, Meaningless-Meaningful, Wise-Foolish, Disreputable-Reputable. Positive and negative poles were varied to avoid positional bias. The instructions were adapted from those given by Osgood (1957, p. 82). The scales were administered during the first testing session, prior to the subjects' exposure to any of the program materials, and readministered at the end of the second session after the post-test.

Procedures

Two groups differing with respect to creativity were established on the basis of their RAT scores. The high group was assigned on the basis of falling at or above the third quartile, with respect to RAT score, from an initial pool of 200 subjects. The RAT scores for the low group feel at or below the first quartile. After Ss' RAT scores had been ascertained they were randomly assigned to one of two treatment conditions: a CR group or a reading group.

RAT

The rationale for the development of the RAT, and the construct on which it was based have been described above. The evidence regarding the RAT's construct validity and reliability will be reviewed in the present section.

Evidence for the construct validity of the RAT includes the following: (1) RAT scores correlated .70 with ratings of creativity made by the instructors of 21 architecture students (Mednick, 1962). (2) RAT scores correlated .55 with ratings of research creativity made by the supervisors of 43 psychology graduate students (Martha Mednick, 1963). (3) RAT scores correlated -.31 with the Crutchfield conformity scores, and .31 with originality scores developed at the Institute of Personality Assessment and Research at Berkeley. The sample consisted of 40 architects (Mednick and Mednick, 1967). (4) RAT scores were found to differentiate significantly between originality of Ss in terms of the infrequency of arriving at certain kinds of anagram solutions (Mednick, 1962). (5) In another study RAT scores were found to be positively correlated with the originality (.38, p .05) and number of different anagram solutions (r=.44, p .01) (Mednick, 1962). (6) RAT scores correlated .38 (p .01) with the number of different associations given to 20 stimulus words (Mednick, 1962). (7) In a study employing the Kent-Rosanoff words Mednick, Mednick, and Jung (1964) found that high scorers on the RAT gave the greatest number of different associations, and maintained the highest speed of association compared to a middle and a low scoring group.

The RAT manual (Mednick and Mednick, 1967) reports that RAT scores have the following correlations with college grades: for samples of 40 architects (-.34), 26 psychology graduate students (-.11), and 74 undergraduate engineers (-.27). Correlations with the SAT scores and Miller Analogy Scores range from .19 to .41. The Spearman-Brown corrected split-half reliability was found to be .92 for 208 Bennington College females, and .91 for 215 University of

Michigan males.

As McNemar (1964) has pointed out so clearly, correlations are less than satisfactory when offered as evidence in this area in view of the homogeneity of the samples employed. This very argument, however, increases the confidence to be attributed to the correlations the RAT is shown to have with rated creativity, since one would--of course--expect substantially higher correlations were the sample more heterogeneous.

The sequence in which the various procedures were administered, as well as other details of the procedures, are given below. All of the procedures of this study were administered to Ss in two separate testing sessions. The interval between the first and second session ranged from one to four weeks.

First Session

During the first session the following procedures were administered to the Ss: (1) A biographical questionnaire on which Ss recorded indentifying information. (2) The Remote Associates Test (RAT) for which the standard 40 minute time limit was imposed. (3) The pre-test for the familiar portion of the instructional program dealing with heart disease. (4) A 95-item multiple choice questionnaire composed of the following subscales: (a) The Achievement Anxiety Test (Alpert and Haber, 1960). (b) The Internal-External Locus of Control Scale (Rotter, Seeman, and Liverant, 1962). (c) Ten items drawn from the attention and distractibility subtests of the imaginal processes inventory (Singer and Antrobus, 1963). (d) Thirty-seven items of a multiple choice questionnaire purporting to measure the need for confirmation (Tobias, 1966). A copy of the 95 item questionnaire with accompanying instructions is given in Appendix C. (5) The general attitude questionnaire described above.

At the end of the first session an appointment was made for the second session.

Second Session

During the second session the program, post-test, and attitude scales were administered. By the time Ss reported for the second session their RAT scores had been determined, and consequently their membership in the high or low creativity groups had been ascertained. Ss were then randomly assigned to either the CR or the reading group.

The CR group received the instructional program in the form reproduced in Appendix D, and reported their answers in an answer booklet, also reproduced in Appendix D. The reading group received the instructional material in a booklet form as reproduced in Appendix D. As soon as Ss completed the program, the post-test was administered. At the conclusion of the post-test the scale measuring attitudes towards the instructional format and the content of the program was given to Ss, succeeded by a readministration of the scales measuring general attitudes towards instructional media.

The materials administered to Ss during the second session were typically given in a quiet, unused classroom. Generally, one to six Ss worked on the materials at the same time under the supervision of a research assistant. No time limits for any of these procedures were imposed; however, the time required by a S for the completion of the program and post-test was recorded. Ss signified completion of one phase of the procedures by indicating to the research assistant that they were ready for the next set of materials. When S completed all of the tasks during this session he was paid $6.00 for his participation.

Subjects

A total of 100 Ss participated in this study. Ss were recruited primarily from educational psychology classes of the City College of New York during the summer and fall of 1967. A small group of Ss were not so recruited but heard about the research and volunteered by appearing at the research offices. Subjects were informed that the purpose of the experiment was to study the relationship between programmed instruction and the way people think.

The identifying data for each of the four subgroups in this investigation appear in Table 2 below.

Table 2. Descriptive Data for Sample

	High RAT		Low RAT	
	CR	Read.	CR	Read.
No. Female	19	19	14	14
RAT	21.1	20.8	9.1	7.9
SAT-V	551	578	448	446
SAT-M	562	554	487	571
GPA	.67	.64	.51	.43
AGE	20.6	20.2	20.6	20.5

The grade point averages and SAT scores for Ss were obtained from the college files.

CHAPTER III. RESULTS

The major results of this project were concerned with the effects of associative creativity, response mode, and familiarity of subject matter on achievement from, and on attitudes to programmed material. The critical data for the effect of these variables were the subscores on the post-test as well as the scores on the attitude scales. Each of these was analyzed by a 2 x 2 x 3 analysis of variance, the third level consisting of three repeated measures.

Achievement Data

The achievement resulting from the instructional material was determined by Ss' scores on the post-test. The post-test had been designed to be divided into three subtests. One subtest measured Ss' achievement on the familiar section of the program, and the other two subtests measured the amount learned from the technical-verbal and the technical-pictorial sections of the program. The basis for the development of the subtests, and their reliability were previously described in the section on development of materials (Chapter II). In view of the fact that each of the subtests had a different number of raw score points, the scores for all Ss were converted into percentages, thereby allowing for the determination of differences among the subtests.

Table 3. Means and Standard Deviations of Achievement Percentage Scores for all Groups on Different Subject Matter.

Group	Subject Matter					
	Familiar		Technical Verbal		Technical Pictorial	
	M	SD	M	SD	M	SD
HI CR	65.3	11.4	73.0	10.1	70.5	14.0
HI Read	67.8	10.2	63.7	13.7	62.1	14.0
LO CR	52.8	16.3	59.4	16.5	61.4	19.2
LO Read	57.9	12.2	54.4	17.5	47.9	21.5

The means and standard deviations for each of the four subgroups on each of three subtests are given in Table 3. The significance of the differences among the various independent variables is given in the results of the analysis of variance shown in Table 4.

Table 4. ANOVA of Achievement Data.

Source	Sum of Squares	df	Mean Square	F
Between Ss	57460.1	99.		
RAT(A)	9804.1	1.	9804.1	20.48*
Response Mode(B)	1704.1	1.	1704.1	3.56
A X B	5.61	1.	5.61	.01
Error Between	45946.3	96.	478.6	
Within Ss	23387.3	200.		
Subtests(C)	251.2	2.	125.6	1.21
A X C	2.02	2.	1.01	.01
B X C	2934.4	2.	1467.2	14.16*
A X B X C	309.4	2.	154.7	1.49
Error Within	19890.2	192.	103.6	
Total	80847.4	299.		

*p = <.001

These results indicate a highly significant difference between the RAT groups. The F of 20.48 is significant beyond the .001 level. Table 3 indicates that the high RAT groups, irrespective of response mode, had higher means on each of the three subtests making up the post-test. Clearly, the high RAT groups achieved significantly more on all aspects of the instructional material than did the low RAT groups.

Table 4 also indicates that there were no overall differences in achievement as a result of response mode to the instructional material. This finding had been expected in view of the fact that differences in response mode were predicted only on the technical material and not on the familiar material. Table 4 also indicates, contrary to prediction, that there was no interaction between RAT and response mode; neither was there any interaction between RAT score and achievement on the three different subtests. As indicated above, the high RAT group obtained higher mean scores on all three subtests than the low RAT groups irrespective of the familiarity or technicality of the material.

Table 4 also indicates a highly significant interaction, *F* of 14.16, significant beyond the .001 level, between response mode and the subtest scores. In order to determine the meaning of this interaction three orthogonal comparisons were computed in the manner advocated by Edwards (1968). In each case the comparisons were between the CR and reading groups, irrespective of RAT score, and achievement on each of the three subtests of the post-test. The first comparison between the response modes on the familiar material gave rise to a *t* of .84 indicating no significant difference between the groups with respect to their achievement on the familiar material. The *t* test for the difference between response mode and the technical material requiring verbal response yielded a *t* of 1.76, significant at the .05 level (one tailed). The final comparison between response modes and technical material requiring a pictorial response resulted in a *t* of 2.69 which was significant beyond the .01 level. These results confirmed the prediction of significant differences between the CR and reading groups on the technical material and no difference on the familiar material.

Specific Attitude Data

At the completion of the post-test *S*s were administered an attitude questionnaire dealing with their feelings toward the format in which the learning material was presented, and which assessed their attitudes towards both the familiar and the technical material in the program. Details regarding the development and reliability of these scales are presented in the previous chapter. In view of the fact that the total number of points for each of the subtests of the total attitude scale were different, the scores were converted to percentages in order to enable an assessment of differences among the various subtests.

Table 5 gives the means and standard deviations for the three attitude subtests and the various groups administered in this study.

Table 5. Means and Standard Deviations of Specific Attitude Percentages Scores for all Groups.

	Attitude Subtests					
Group	Format		Familiar Material		Technical Material	
	M	SD	M	SD	M	SD
HI CR	48.0	15.6	62.6	15.0	65.6	14.3
HI Read	47.6	12.7	60.3	16.2	58.0	17.9
LO CR	56.2	18.8	55.3	19.2	65.7	16.0
LO Read	47.5	17.2	56.6	19.0	59.1	21.1

Table 6 gives the results of the analysis of variance of the attitude data. As with the achievement data, this analysis consisted of a 2 x 2 factorial design with a third level consisting of three repeated measures on each subject. In this instance the repeated measure consisted of: (1) attitudes toward the format of the material, (2) attitudes toward the familiar material, and (3) attitudes toward the technical material.

Table 6. ANOVA of Specific Attitude Results.

Source	Sum of Squares	*df*	Mean Square	*F*
Between *S*s	47115.7	99.		
RAT(A)	5.88	1.	5.9	.01
Response Mode (B)	1232.2	1.	1232.2	2.58
A X B	27.0	1.	27.0	.06
Error Between	45850.6	96.	477.6	
Within *S*s	48434.0	200.		
Subscores(C)	7987.7	2.	3993.9	20.06*
A X C	1170.8	2.	585.4	2.94
B X C	550.1	2.	275.0	1.38
A X B X C	492.4	2.	246.2	1.24
Error Within	38233.0	192.	199.1	
Total	95549.7	299.		

*_p_. = <.001

The analysis of variance indicates that there were no differences between high and low RAT groups, and no differences between response modes with respect to the attitudes toward the material. Significant differences, with *p* less than .01, were revealed among the three different measures. The subsequent *t* test indicated that there were highly significant differences between the attitudes toward the format of the material in general, and the attitudes toward both familiar and technical material. The *t* for this comparison was 5.3, significant beyond the .001 level. The comparison between *S*s' attitudes toward the familiar and the technical subject matter yielded a *t* of 1.70, significant at the .05 level.

Program Error Rates

The number of errors committed on the program were available, of course, only for the CR groups. Error rates were established by scoring the program in accord with the criteria developed for this study. Pictorial responses were scored on a two point scale for drawings of damage to the heart, to an eight point scale for tracings of the electrocardiographic responses. Verbal responses were typically scored on a one, for correct, to zero, for wrong, scale. In order to make all of the responses comparable, the error rates were ascertained by converting each response to a percentage correct, in this way eliminating differences in the number of points assigned to the various responses. The percent correct for each response were summed into three subscores, representing the familiar, verbal technical, and pictorial technical subject matter. Each was than divided by the number of such responses yielding three scores indicating the mean percentage correct that Ss achieved on the three parts of the program. The data thus conformed to an analysis of variance with two different groups, high RAT and low RAT, and three repeated measures, namely the percentages correct for the familiar material, for the technical material requiring verbal responses, and for the technical material requiring primarily pictorial responses.

The means and standard deviations for the high and low RAT groups on the familiar and on the two types of technical material are given in Table 7.

Table 7. Means and Standard Deviations of Error Rates on all Types of Subject Matter.

Group	Subject Matter Familiar		Technical Verbal		Technical Pictorial	
	M	SD	M	SD	M	SD
HI RAT	98.4	1.98	87.8	8.58	82.4	9.67
LO RAT	94.9	5.46	81.6	13.64	72.5	17.01

The significance of the differences is given in the results of the 2 x 3 analysis of variance reproduced in Table 8.

Table 8. ANOVA of Program Error Rate.

Source	Sum of Squares	df	Mean Square	F
Between Ss	12497.0	49.		
RAT(A)	1600.6	1.	1600.6	7.05*
Error Between	10896.4	48.	227.0	
Within Ss	14969.3	100.		
Error Rates(B)	9377.8	2.	4688.9	84.45**
A X B	261.3	2.	130.6	2.35
Error Within	5330.3	96.	55.5	
Total	27466.3	149.		

*p =<.05
**p =<.001

The results of the analysis of variance indicate that the differences between the high and low RAT groups are significant, F = 7.05, p less than .02. Furthermore, the differences among the measures were significant beyond the .001 level. The interaction between groups and measures was not significant. The t tests between the measures indicate that there was a significant difference between the error rates on the familiar material and those of the technical verbal material (t = 8.0), and in turn between the latter and the pictorial material (t = 4.87).

Effects of Pre-Score and SAT

Prior to being exposed to the instructional material, Ss took a pre-test to assess their knowledge of the familiar section of the instructional material. The SAT scores of Ss were also obtained from the college files and from the Educational Testing Service in order to determine whether differences in the SAT scores could account for the results. In this process it was revealed that SAT scores were available for only 94 of the 100 subjects. Consequently, a multiple linear regression analysis was computed for these 94 Ss in order to determine whether the SAT scores and the pre-score contributed a significant percentage of variance to the post-test results.

The correlation between the RAT score and the SAT-Verbal score for the 94 subjects for whom these data were available was .565. For a larger group of 140 Ss, 44 of whom fell in the middle of the distribution with respect to RAT score, the correlation between the SAT Verbal score and the RAT score was .518. It, therefore, seemed clear that the high relationship between RAT score and SAT-Verbal score was not purely a function of the heterogeneity of the Ss employed in this study.

A multiple regression analysis, as advocated by Beaton (1964), was computed in order to determine whether the pre-score and the SAT scores contributed a significant percentage of the variance to the final results, in the presence of the experimental variables. RAT level was converted to a group membership variable by generating a vector in which high RATs were coded 1 and low RATs -1. Reading and CR groups were similarly converted and coded: 1 for CR, and -1 for reading. The resulting correlation matrix between the independent variables in this study and a variety of dependent variables, as well as the correlations between the independent variables and the number of the scores Ss obtained on the various personality and attitude scales administered to them, is reproduced in Table A-1 (see Appendix A). The significance of the SAT scores and pre-scores obtained by Ss on a number of the dependent variables in this study was ascertained in the following manner: First, a full model was computed which contained the following vectors regressing onto a criterion: (1) RAT, (2) response mode, (3) interaction vector between response mode and RAT obtained by cross-multiplying the other two vectors, (4) SAT score, and (5) pre-score. The significance of the contribution of SAT and pre-scores was then determined by computing a restricted model which included all of the elements in the full model except either the pre-score vector or the SAT vector. The difference between the full model and the restricted model gives rise to a ratio which has the F distribution. The data were analyzed by a computer program provided by Veldman (1967). Probabilities associated with each F test were determined by the exact probability procedure (Jaspen, 1965).

Significance of SAT. The SAT scores, in the presence of the RAT variable, were found not to contribute a significant percentage of variance to any of the dependent measures in this study. The two areas in which the SAT came closest to significance were in its effect on achievement for familiar and for technical textual material. It was found that for familiar material SAT score accounted for .017 percentage of the variance, and this gave rise to an F ratio of 2.46 significant at the .15 level. On the technical material requiring verbal responses SAT scores contributed .019 percentage of the variance, giving rise to an F ratio of 2.26, $p = .13$. This analysis indicated that in the presence of the RAT the SAT contributed little unique variance to the major dependent measures in this study. In view of this fact it was found unnecessary to use the SAT as a co-variat.

Significance of Pre-Score. There were no differences in pre-score among the groups ($F = 1.54$, df 3,90); the mean pre-score for all groups together was 9.6, or 32% of the total number of points. The pre-score did not contribute a significant percentage of the variance to any of the critical dependent measures in the study; though, in several instances the contribution was of borderline significance. Pre-score accounted for .023 percentage of the variance on total achievement, giving rise to an F of 2.58, $p = .11$. Pre-score also accounted for .031 percentage of the variance of achievement on technical material requiring textual responses. The F ratio for this comparison was 3.64, significant at the .06 level. This value was closest to achieving statistical significance among all the effects of pre-score on the major dependent variable in this study. In view of the fact that only one of the comparisons came close to significance and all the others were clearly failing of significance, it was deemed unnecessary to include the pre-score as a co-variat.

Test and Program Times

The significance of differences in the time taken to complete the post-test, and the time taken to work on the instructional materials, were determined by multiple linear regression analysis. Regression analysis, rather than analysis of variance, was utilized in view of the fact that the SAT accounted for a significant percentage of variance in each instance, and because of the unequal ns among the groups. Since SAT had to be co-varied, and SAT data were available for only 94 Ss, the N for these analyses is based on that total.

Program Time.

The mean and standard deviation for the amount of time taken to complete the program and the post-test are given for each of the subgroups in Table 9. As expected, the results indicated that the constructed response groups took more than twice as much time as the reading groups to complete the program. Regression analysis indicated that the response mode variable accounted for 60% of the variance and resulted in an F of 151.46 which was significant well beyond the .001 level. SAT score, in the presence of the other variables, accounted for .014 percentage of the variance which was barely significant at the .06 level. RAT group membership, in the presence of SAT score, did not account for a significant percentage of variance.

Table 9. Means and SDs of Time, in Minutes, Taken to Complete Program and Post-test.

Group	Program		Post-Test	
	M	SD	M	SD
Hi CR	76.9	18.8	19.5	5.0
Hi Reading	34.1	12.9	23.3	6.4
Lo CR	84.7	19.2	17.3	4.5
Lo Reading	42.0	16.0	26.4	14.4

Test Time

The mean and standard deviations for the length of time required to complete the post-test are given in Table 9 for each of the groups in this analysis. Regression analysis indicated that the SAT accounted for 4% of the variance giving rise to an F ratio of 4.44 significant beyond the .05 level. In the presence of SAT, RAT group membership did not contribute a significant percentage of variance to the amount of time taken to complete the post-test, neither did the response mode ($F = < 1$), or the interaction between them ($F = 1.73$, $p = > .10$).

Blackout Ratio

In the paper by Holland (1967) much of the previous work of the blackout ratio was summarized. In that paper Holland indicates that one of the programs with a low blackout ratio was the original version of the program known as The Diagnosis of Myocardial Infarction. The blackout ratio for the pictorial portion of that program was 11.1% and that of the verbal part of that program appeared to be about 15%. In view of the fact that the technical part of the instructional material utilized in the present research was based on the earlier program, covered all the subject matter covered in the previous program, yet reduced the overall number of frames by 30, it was felt to be unnecessary to determine the blackout ratio for the technical part of the instructional material. The familiar part of the subject matter had been newly constructed for the present research and therefore data as to its blackout ratio was gathered for the present study.

A copy of the instructional program covering the familiar part of the present subject matter was mailed to Frederick D. Kemp for the purpose of ascertaining its blackout ratio. Kemp was a co-author of the two studies introducing the blackout ratio, and identified as the investigator responsible for preparing the blackout ratios on all of the programs investigated in those experiments. The blackout ratio ascertained by Kemp for the familiar part of the program turned out to be 13%. In order to determine whether the blackouts prepared by Kemp give rise to a similar error rate, compared to the standard version of the familiar part of the program, 15 Ss were run only on the familiar part of the program. The overall error rates for these Ss turned out to be not significantly different from the overall percentage correct of 96.6% obtained for all the Ss in the present study (t = 1.2).

General Attitude Scales

The general attitude scales were scored by assigning a value of 1 to the negative pole for each term, and a 7 to the positive pole. The six scales on each term could, thus, add up to a maximum score of 42 on each term, and a minimum score of 7. The results of these scales were difficult to analyze because 16 of the 100 Ss failed to rate their attitudes to one or more terms during the first or second administration. Despite the known unreliability of difference scores, it seemed most efficient to analyze the data in terms of the changes of attitude after exposure to the learning materials. Subjects who omitted a term either in the first session, or during the readministration, were assigned a change score of zero. For all others the difference between the pre- and post-scores was determined. The mean of these change scores are given in Table 10 for each of the four groups, and for all 20 terms.

The change scores were submitted to a 2 x 2 analysis of variance with a third level consisting of the 20 attitude scores assigned by Ss to the terms. The analysis is shown in Table 11, and indicates that there were no overall differences in change scores between the RAT groups, nor between the response modes. These two variables did, however, interact, the F of 4.22 being significant at the .05 level. There were highly significant differences among the terms with respect to change scores, however, these did not interact with either RAT level or response mode. In view of the fact that there was no interaction between the independent variables and the measures, the significant interaction between RAT level and response mode is difficult to interpret. It suggests that there were overall differences among the variables for all 20 terms taken as a whole, but not on any one group of terms. Since differences had been expected on the terms connoting programmed instruction, and not on the others, the meaning of this interaction is obscure.

Table 10. Means and SD's of Attitude Change Scores

Terms	High CR	RAT Read	Low CR	RAT Read
Exercise Book	1.64	-.60	-.96	.28
Study Guide	1.36	2.60	.88	-.28
Text Book	-1.36	-.60	-.40	-.32
Work Book	-.88	.20	-1.92	-1.20
Flashcard	-.52	.96	.32	3.52
TV Tutor	-.44	2.80	2.68	2.24
Educational TV	-2.08	1.88	-.48	-2.88
Audio Visual Education	-1.44	1.80	-.36	-1.40
Film Strip	-.44	1.80	-.36	1.04
Educational Film	1.28	1.04	-.84	-2.04
Tutor Text	-.08	1.72	1.76	-.72
Programmed Instruction	-.60	2.44	2.52	2.24
Programmed Self Study	.96	1.40	1.80	.40
Programmed Text	1.52	2.44	2.80	2.16
Self Instructional Program	1.48	2.92	1.76	.32
Automated Instruction	-.72	4.04	2.48	2.60
Educational Technology	.36	3.04	.96	-3.60
CAI	.24	-.56	.32	.20
Teaching Machine	.44	2.52	.92	1.72
Mechanized Tutor	.60	2.56	4.08	2.44

Table 11. ANOVA of Attitude Change Scores

Source of Variation	Sum of Squares	df	MS	F
Between Subjects	16160.8	99		
A (Rate)	53.8	1	53.8	0.34
B (Mode)	122.0	1	122.0	0.76
A x B	672.8	1	672.8	4.22*
Error Between	15312.2	96	159.5	
Within Subjects	82744.3	1900		
Trials (Change Groups)	2175.5	19	114.5	2.66**
A x Trials	921.0	19	48.5	1.13
B x Trials	453.9	19	23.7	0.56
A x B x Trials	800.9	19	42.1	0.98
Error Within	78394.0	1824	43.0	
TOTAL	98905.1	1999		

*$p \leqslant .05$
**$p \leqslant .01$

Correlational Data

All of the *S*s participating in this study were given a number of scales for exploratory purposes. The scales were described in the materials section of Chapter II. The correlations between the scores on these tests and the dependent measures in this study for the total sample are given in Table A1 of Appendix A. In an attempt to clarify whether these scores had different relationships for the reading than for the CR groups, these correlations were computed separately for each group. Table 12 gives the results of that analysis.

Table 12. Correlations Between Test Scores on Program Variables Computed Separately for CR and Reading Groups.

		Program Variables			
Tests		Familiar	Tech. Text	Tech. Pict.	Total
AAT+	CR	.00	.14	.08	.09
	Reading	.39*	.45**	.31*	.40**
AAT-	CR	-.16	-.19	-.13	-.17
	Reading	-.29*	-.21	-.20	-.28**
C	CR	-.11	-.04	-.01	-.05
	Reading	-.16	-.10	-.20	-.22
D	CR	-.02	-.03	-.01	-.02
	Reading	.20	.00	.17	.14
I/E	CR	-.03	-.08	-.05	-.01
	Reading	.18	.09	.04	.15
AAT[1]	CR	.16	.21	.14	.18
	Reading	.39**	.45*	.33	.43**

*Significant at $p \leqslant .05$.
**Significant at $p \leqslant .01$.
[1] Multiple *R*.

Table 12 suggests that the correlations between the anxiety scales and the different achievement indices yield the greatest differences. However, a test for the significance of the difference between correlations computed on different samples (Jones, 1968) yielded a chi square value of 2.88 ($df = 1$) which failed of significance at the .05 level.

CHAPTER IV. DISCUSSION

The major results of this experiment confirm the presence of a strong interaction between the technicality of subject matter and the superiority of the CR response mode. Contrary to expectations, familiarity of subject matter did not interact with associative creativity. The creative group achieved more in all of the areas tapped by the post-test and program. Finally, the high correlation between the SAT-Verbal scale and the RAT raise questions about the degree to which the RAT is a measure of verbal creativity. The implications of these results will be examined below.

Associative Creativity and Programmed Instruction

One of the major expectations of this project had been that associative creativity would interact with type of subject matter in its effect on achievement from programmed material. Specifically, it had been anticipated that for familiar subject matter the low RAT group would achieve more than the high group, whereas for technical subject matter no differences had been expected. This expectation was not supported by the data. Instead, the high RAT group achieved more on all types of subject matter. There appeared to be two major reasons for the overall superiority of the high RAT group, the test on which the Ss were classified with respect to the remoteness of their associations--the RAT, and the nature of the reading and CR versions.

RAT and Verbal Ability

The RAT purports to be a test of creativity as conceptualized from an associationist's point of view. Essential to the conception of creativity, from this standpoint, is the notion of the ability to make associations, which have a low frequency of occurrence, and to combine these into new response elements. Mednick (1962) outlines this argument, and offers the RAT as an operational measure of the creative process from an associationist's point of view. Construct validity in favor of the RAT has been summarized previously (Chapter II), and is persuasive in relating scores on this test to a number of indices of associative fluency, novelty, and originality.

It would seem clear that the ability to make mutually remote verbal associations and combine these into new response elements ought to be related to verbal ability. The extent of this relationship is, however, something of a problem. In the RAT manual (Mednick and Mednick, 1967) correlations of .34 are reported with the verbal part of the SAT. Correlations with other measures of verbal ability or intelligence are reported to be in the .40 range. The findings of the present study indicate that the relationship between RAT and verbal ability is somewhat more substantial than previously believed. Evidence for this interpretation emerges from a number of sources. First of all, correlation for the sample employed in the present study between the SAT-Verbal score and the RAT was .565. For a larger group of 140 subjects which was less heterogeneous with respect to verbal ability the relationship was not markedly attenuated as seen by this group's correlation of .518. The higher correlations between verbal ability and RAT score obtained in the present study, compared to those previously reported, can probably be attributed to the greater hetergeneity of SAT scores in the present sample. This can be seen from the fact that the standard deviation of the SAT scores for the present sample was 105.6 equaling that for the SAT norm group. The greater heterogeneity of the present group with respect to SAT score is an outgrowth of the admissions policy of the City University of New York. At the City University students who achieve low scores on the scholastic aptitude tests may be admitted to one of a number of community colleges of the University. Upon successful completion of two years in junior college these students have the option of transferring to one of the senior colleges. Due to this process students with very low scores on the SAT are, nevertheless, able to enter the senior colleges. It seems probable that a number of such students ended up in the sample employed in the present study. For this reason the relationship between RAT scores and verbal ability was higher in the present study than had been previously reported.

Another line of evidence suggesting that there is a considerable degree of common variance between RAT and SAT-Verbal ability is seen from the relationship of both of these scores to the critical dependent measure in the present study. Despite the fact that the total low RAT group had a mean SAT score of 451 and the high RAT group a mean SAT score of 562, ($\underline{t}$ = 6.43), it was found that in the presence of the RAT variable the SAT contributed an insignificant amount of variance to achievement on the familiar, and on the two kinds of technical material. This finding is particularly impressive in view of the fact that the SAT had significant correlations with most of the dependent measures in this study, as shown in Table 13. Equally noteworthy is the similarity between the correlations of the SAT and RAT scores and the dependent scores illustrated in Table 13. Incidentally, adding the SAT mathematical score does not change the correlation between RAT and SAT at all, the multiple $\underline{R}$ between both

Table 13. Correlations Between SAT and RAT and Selected Dependent Measures.

	Achievement on:				Time on:	
		Technical				
Tests	Familiar	Verbal	Pictorial	Total	Test	Program
SAT	.36**	.33**	.12	.25*	-.22*	-.17*
RAT	.44**	.39**	.27*	.38**	-.10	-.06

* = significant at $p \leqslant .05$

** = significant at $p \leqslant .01$

SAT scores and the RAT being .568, compared to the *r* of .565 between SAT-Verbal alone and RAT. Similarly, the multiple correlations between both SAT scores and the dependent measures in this study are hardly different from those of the SAT-Verbal alone. These findings suggest that within the limits of this investigation the RAT and the SAT-Verbal were almost interchangeable.

It would appear from the foregoing that the present investigation was more nearly a study of the effects of verbal ability on achievement from PI, than of the effects of creativity. When the present data are compared to those of other investigations reviewed above (Chapter I) dealing with the effect of verbal ability or intelligence on achievement from programmed materials, the data are highly consistent with the results of those studies. Of most direct relevance is the study by Oppenheim (1965) who found no interaction between scholastic ability, as measured by the SAT, and achievement on programmed material. This study is especially relevant to the present investigation in view of the fact that Oppenheim (1965) employed an earlier version of the technical part of the program used in the present study. The present findings agree closely with those of Oppenheim who found his high ability groups to achieve significantly more, irrespective of response mode, on both the verbal and technical pictorial material. The present investigation extends those findings by indicating that there was also no interaction between ability and achievement on familiar material; here again the high ability group's performance was significantly greater than that of the low ability group.

Reading Version. In the present investigation achievement from PI, meaning the CR group, was compared to achievement from reading the program cast in the form of completed statements requiring no overt response--i.e., to the reading group. A number of other investigators (Anderson, 1967) have also used this methodology to evaluate the effectiveness of programmed instruction. Implicit in such a comparison is the notion that the reading version of an instructional program is more nearly comparable to a conventional textbook than it is to an instructional program. Furthermore, in the present study it was also assumed that the reading version would present a less boring, less structured format which was more conducive to achievement by creative subjects. Analysis of the reading version of the program employed in the present study indicates this to be a questionable assumption. The reading version of a program appears to be subject to the same degree of routine, repetitiveness and conventionality as the CR version. It would appear possible that the requirement of going through the reading version of the program, without the interruptions occasioned by making an overt response, may well be a more repetitive exercise than studying the same materials by the CR version. Thus, even were the RAT a better measure of creativity than is indicated in the present study, it seems unlikely that creative Ss would perform differently on the reading version than on the CR version of the same program.

Experience with the present and previous studies (Tobias and Weiner, 1963; Tobias and Williamson, 1968),suggests that the determination of the effectiveness of PI by comparing a CR group with a reading group should be closely examined. Implicit in such a procedure is the notion that the reading version is analogous to a non-programmed textbook and that, therefore, the effectiveness of PI can be determined by comparing a CR to a reading group. Analysis of reading versions has suggested that this is a questionable assumption. The reading version of an instructional program differs from the conventional textbook material in a number of important ways. First, in a reading version the organization of subject matter, stimulus organization, is much clearer than it is in the conventional textbook. Second, the thought units in reading versions of instruction programs are significantly smaller than similar structures in a textbook. Third, there is significantly more repetition of subject matter in the reading version of a CR program than in a conventional textbook. The fact that overt responses are not required in a reading version does not prevent S from being exposed to the salient points of the program segregated into small and discrete thought units, which are repeated far more frequently than they would be in a textbook. Clearly, it can be safely assumed that the reading version of a program differs from a CR version; however, it may differ to an even greater degree from conventional textbooks.

If a comparison of the effectiveness of a CR program and a conventional textbook is useful, the preceding analysis suggests that comparing a reading version to a CR program is not the best way to study this problem. An alternative way would be to rewrite the constructed response version in a manner similar to the paragraph organization of a textbook. Such a procedure would have the disadvantage of reducing the similarity of the stimulus organization in the two formats, and hence lower the comparability between the achievement from such a reading version and a CR version. In other words, the instructional materials would differ more from one another than they do in present comparisons of the two versions. The reduced degree of similarity would, however, be no greater than normally exists between a textbook and a program, and hence be a truer test of the presence of achievement differences between them.

Response Mode and Subject Matter

This study provides strong support for the interaction between familiarity of subject matter and response mode. The CR group achieved significantly more than the reading group on both technical material requiring verbal responses, and on technical material requiring pictorial responses. As expected, there was no difference between the response modes on the familiar material.

The response mode data are a replication and extension of the work of Cummings and Goldstein (1963). These investigators used an earlier version of the technical part of the subject matter employed in the present research. Cummings and Goldstein found that their CR group achieved significantly more, at the .05 level, than a covert response group for the technical verbal material. For pictorial material the CR group's achievement was significantly greater at the .01 level. Even though the present investigation compared the achievement of the CR group to a reading group, rather than a covert response group as used by Cummings and Goldstein, the findings with respect to the verbal and pictorial material are identical. The work of Cummings and Goldstein is extended in the present investigation by virtue of the fact that an introductory set of frames dealing with material with which Ss were expected to have familiarity was employed. On this material, as expected, there were no differences in achievement between the response modes. The findings in both of these investigations clearly indicate that for technical subject matter with which the Ss have little prior familiarity the CR response mode results in higher achievement. The fact that both studies found the differences to be greater for pictorial material than for verbal material could be attributed to a number of possibilities. First, the pictorial material is of such a character that mastery of the subject matter more clearly required making an overt response than is required by verbal material. The electrocardiographic tracings which compose the greatest bulk of the pictorial responses in the present study required Ss to make an enormous number of differentiations between tracings of superficially similar characteristics. It would appear that the best way to make these differentiations is by actually drawing tracings with different characteristics. The second possibility accounting for the difference between the pictorial and verbal sections is that the material requiring pictorial responses was more technical and less familiar to Ss, and certainly was material of the kind that the typical undergraduate student had rarely encountered in his previous experience. Finally, the fact that few pictorial responses are required in the academic functioning of college students, the Ss in this study, adds to the lack of familiarity of such material. The familiar material in this study was drawn from the same area as the technical subject matter, namely the area of heart disease. The principle difference between the familiar material and technical material was in the degree to which Ss had been exposed to the content of the program prior to studying the subject matter for the present research. The fact that during tryout the scores on pre-test for the familiar material averaged about 50%, whereas for the technical material virtually no prior knowledge was demonstrated, confirmed the classifications of the subject matter. These factors strengthen the interpretation that differences between response modes on the technical material, and not on the familiar, can therefore be attributed largely to Ss' previous experience with the content of the program.

Most recently Karis, Gilbert and Kent (1968) verified the interaction between subject matter familiarity and response mode. These investigators found CR to be superior to covert responding when perfect recall of medical terminology was required. As the criterion became less stringent, i.e., minor alterations in the answer were considered acceptable, the superiority of the CR group disappeared. There were also no differences between response modes when definitions of medical terms, rather than the terms themselves, were required. Together with the results of the present investigation, the findings of Cummings and Goldstein, and of Williams (1962, 1965, 1966), these data suggest that the superiority of the CR mode appears to be highly related to the technicality of the subject matter. The findings of Karis, Gilbert and Kent (1968), as well as those of this study, suggest that even in the same content domain, as familiarity with the subject decreases the superiority of the CR mode becomes less pronounced.

Time

The present study in accord with the results of other investigations, had found a highly significant difference in the amount of time taken to complete the instructional material between the CR and the reading group. In the present investigation the CR groups took a total of 80.8 minutes to complete the subject matter whereas the mean for the reading group was 38 minutes. The point is sometimes made that such data suggest that the reading version is more efficient. By efficiency is meant that a ratio of achievement over amont of time taken would result in significantly higher achievement by the reading compared to the CR group. It would appear that such a comparison is meaningful only in those instances when the amount of time required to master subject matter is of greater, or at least equal, importance to the degree of mastery attained. One would assume that instances where this is true are relatively rare. Certainly, for subject matter such as that employed in the present investigation a greater degree of mastery is well worth the extra amount of time required. One would certainly hope that even if an electrocardiographic technician has to take twice the amount of time to improve his knowledge of the subject matter, the increased mastery is well worth the extra time required.

Blackout Ratio and Response Mode

Holland (1967), and Kemp and Holland (1966) suggest that previous studies of PI have failed to demonstrate the superiority of the response mode due to the poor quality of the programs employed in those investigations. Specifically, they have suggested that those studies which have found no differences among response modes have utilized programs with high blackout ratios. The high ratio indicates that Ss can make the right responses irrespective of the material introduced by a frame. In other words, the correctness of a response is not contingent upon reading the frame. In view of that fact, Holland continues (1967), it is not surprising that making a response does not result in higher achievement since responding is irrelevant to what the program purports to teach.

The present study suggests that the lack of superiority for the CR mode cannot be attributed entirely to the blackout ratio. The familiar portion of the program employed in the present study had a blackout ratio of only 13 percent. Holland (1967) found the blackout ratios for the technical verbal part of the myocardial infarction program to be about 15%, and 11% for the pictorial. Since the present technical program covers the same subject matter as the version used by Holland, but in 30 fewer frames, the blackout ratios for the program used in this study would be at least as low, if not lower, than those reported by Holland, and not markedly different from that of the familiar portion of the program used in this study. The results of the present study, therefore, indicate that even if the blackout ratio for a program is quite low and the program contains non-technical, familiar subject matter, the CR mode may well result in no higher achievement than reading the material would. Previous research which has varied the familiarity of the subject matter, such as that of Karis, Gilbert and Kent (1968) did not report blackout data for the programs employed. The present study suggests that S's familiarity with the material to be learned may well be of greater importance with respect to which response mode results in greater achievement than the blackout ratio of the program employed.

Individual Differences and PI

One of the major results of the present investigation was the absence of an interaction between creativity and achievement from PI. Individual differences in creativity, as measured by the RAT, did not act as a useful differentiating variable with regard to the mode of instruction from which Ss could be expected to profit most. As indicated above, these findings are in accord with others in the area of intelligence levels and response mode to PI, and suggest that in this general cognitive area there is little interaction between the individual difference variables and the achievement to be gained from working programmed materials.

A number of research instruments designed to measure attributes in affective domain were administered to the Ss in this study for exploratory purposes. The first of these, the Achievement Anxiety Test, AAT (Alpert and Haber, 1960), yielded some interesting findings. In all instances, the correlations between the facilitating and debilitating anxiety scales were higher for the reading than for the CR groups. In most of these instances the correlations for the reading group were significant, while those for the CR group were not. This pattern was also true for the multiple correlation between both scales and the various achievement indices. The difference between the groups on any one of these correlations is not significant, but their pattern and direction is in accord with the expectations that the programmed format provides enough support for anxiety to be relatively inoperative while learning from programmed materials. On the other hand, the achievement by use of the reading format which provides less confirmation regarding how S is doing would be expected to be more affected by anxiety. While the correlations are low, and not significantly different from one another, the data suggest that the interaction between anxiety and PI is a fruitful area for further exploration.

Differences in the pattern of correlations between the groups on a number of the other scales had been expected. Thus the C Scale (Tobias, 1966) had been designed to measure the degree to which a subject required confirmation or feedback. The expectation had been that a high need for confirmation would contribute negatively to achievement for the reading group, which received low confirmation, but be essentially unrelated to achievement for the CR group. Again, the results were in the predicted direction in all instances, though none of the correlations for the reading group achieved significance.

The expectations for the Distractibility scale (Singen and Antrobus, 1963) in the present study were similar to those of the C Scale. It had been thought that S's susceptibility to distraction would correlate more highly with achievement in the reading than in the CR group. The latter group, by virtue of the feedback provided, was expected to be less subject to distraction, and hence S's susceptibility to distraction ought to be less of a factor in his achievement. The data relating to this scale were too inconsistent to interpret.

The results of this project are not encouraging with respect to the interaction between individual difference variables and PI. The failure to obtain an interaction between creativity levels and response mode, or subject matter variables, does not support the expectations of Cronbach (1967) with respect to PI at least. Of course, the limitations of the present study with respect to the program and creativity test employed limit the generality of this finding. On the other hand, other investigators, using different programs, and different individual difference variables, have had similar results. While the research effort in the area of individual differences and PI is quite limited at present, the data at hand are not particularly encouraging.

It would appear to be important to reconsider the essential approach to the study of individual difference and instructional variables. Typically, such studies assign the individual difference variable on the basis of a test score, and then correlate it with achievement in a situation labeled research, or study whether it interacts with other independent variables which are experimentally varied in the research situation. Such investigations suffer from a number of difficulties. First among these is the reliability and construct validity of the test involved. However, even a sound instrument does not guarantee that the attribute being measured actually exists in the brief time span given to the experimental task. In the area of anxiety, for example, Tobias and Williamson (1968) suggested that the assumption that an undergraduate student is anxious in an experimental situation because he had a high score on an anxiety scale is most tenuous.

In experimental tasks lasting relatively brief periods of time there would appear to be no substitute for experimentally manipulating the variable studied. On the other hand, in field studies where a pupil is exposed to a set of materials, or an instructional mode, for long periods of time in a lifelike situation, it seems more possible that interactions with variables assigned on the basis of test scores could emerge. The lifelike nature of such field environments, and the longer time periods involved, naturally impose formidable difficulties in controlling for the effects of extraneous variables. It seems likely, however, that, despite their difficulties, the manipulation of individual difference variables, or study of their operation in the field, are superior to the designs employed to this point in the study of the interaction between individual differences and achievement from programmed instruction.

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APPENDIX A

Table A1. Correlation Matrix Between All Variables.
Part I

Variable	No.	2	3	4	5	6	7	8	9
Familiar	1	61	44	67	-22	01	-13	-19	-12
Text	2		68	87	-35	07	-18	-27	23
Pictorial	3			94	-29	09	-07	-18	37
Total Achievement	4				-34	08	-12	-23	28
Format - Attit.	5					10	29	74	-00
Familiar- Attit.	6						50	58	-06
Technical- Attit.	7							82	12
Total Attitude	8								
Program Time	9								
Test Time	10								
Pre Score	11								
SAT Verbal	12								
G P A	13								
Age	14								
Sex	15								
RAT Vector	16								
Response Mode Vector	17								
Interaction Vector	18								
AAT+	19								
AAT-	20								
C Scale	21								
Distractibility	22								
I/E Score	23								

Table A1. Correlation Matrix Between All Variables.
Part II

Variable	10	11	12	13	14	15	16	17	18	19	20	21	22	23
1	19	20	36	22	10	04	42	-20	08	15	-19	-13	06	05
2	02	19	33	28	04	-04	37	18	09	27	-22	-13	-05	20
3	04	08	12	03	11	-05	29	24	-06	16	-12	14	10	04
4	07	15	25	15	06	-04	38	16	00	22	-19	-16	07	10
5	-13	-07	05	03	-04	-16	-11	08	-12	-07	-10	09	01	-00
6	-14	08	17	03	-08	-21	13	01	03	04	-07	-36	-03	-17
7	-12	-02	15	01	-09	03	-03	20	-02	-20	08	-21	08	-02
8	-17	-03	15	03	-09	-13	-05	15	-07	-13	-03	-16	04	-06
9	-13	-14	-22	05	26	08	-14	78	00	-02	06	-00	14	11
10		03	-17	-07	02	01	-03	-35	14	04	-03	05	06	-24
11			19	06	02	-22	08	-20	02	03	-04	-10	-10	07
12				41	-23	05	56	-06	-03	07	-07	-12	06	21
13					01	31	27	09	-01	28	-20	-02	-11	18
14						-12	-00	07	04	00	-04	-06	-17	-01
15							11	15	-16	06	01	27	03	08
16								00	-02	04	-12	-14	-01	11
17									-00	09	09	-05	08	14
18										17	16	-04	13	-02
19											-47	02	-33	03
20												-04	28	14
21													-12	-06
22														22

APPENDIX B. Pre-test.

Name________________________________ Date__________________________

1)The major cause of death and physical disability in the United States is:

____.

2)Prevalence is defined as:

____.

3)Incidence is defined as:

____.

4)Coronary disease is defined as a type of heart disease associated with:

____.

5)Name six risk factors with respect to coronary disease:

_____________________________ _____________________________

_____________________________ _____________________________

_____________________________ _____________________________

6)Approximately what percentage of death are due to heart disease?

7)Overloading of the heart means:

____.

8)What is serum cholesterol?

____

9)How do high levels of serum cholesterol affect the arteries?

____.

10)What changes in the arteries are attributable to high blood pressure?

______________________________________ ____.

11)Complete the generalization regarding the effects of risk factors on the chance of developing coronary disease: The greater the number of risk factors, the

______________________________________.

12)Rank the following age groups in terms of their likelihood of developing heart disease- from the age group that is least likely (1) to the age group that is most likely (5).

Age group	Rank
25-29	___
35-39	___
45-49	___
55-59	___
65-69	___

13)For every two deaths of non-smokers, how many smokers are likely to die as a result of illnesses associated with the heart?__________________

14)For every six people with high serum cholesterol concentrations in their blood, how many people with low serum cholesterol concentrations are likely to develop of the heart?

____

15)For every 20 people who at age 60 have illnesses of the heart, how many 40 year olds are likely to have the same illnesses?

____

16)What are three possible effects of high blood pressure on the heart?

a)______________________________________

b)______________________________________

c)______________________________________

17)For each of the following pairs, check the one that is more likely within each pair to develop illnesses associated with the heart or whether there is no difference between two.

a)Week-end athlete___ Summer athlete___ No difference_____
b)Physical Ed. Teacher___ Elem. Ed. Teacher____ No difference____
c)Bank President _____ Bank Clerk_____ No difference

APPENDIX B. Post-test.

Name ______________________ Date ______________________

1) The major cause of death and physical disability in the United States is:

2) Prevalence of a disease is defined as:

3) Incidence of a disease is defined as:

4) Coronary disease is defined as a type of heart disease associated with:

5) Name 9 risk factors with respect to coronary disease:

6) Excessive strain on a weakened heart is defined as:

7) What is serum cholesterol?

8) How do high levels of serum cholesterol change or affect the following?

a- walls of arteries ______________________

b- size of arteries ______________________

c- blood flow ______________________

APPENDIX B. Post-test.

Name ______________________ Date ______________________

1) The major cause of death and physical disability in the United States is:

____

2) Prevalence of a disease is defined as:

____

3) Incidence of a disease is defined as:

____

4) Coronary disease is defined as a type of heart disease associated with:

____

5) Name 9 risk factors with respect to coronary disease:

______________ ______________ ______________

______________ ______________ ______________

______________ ______________ ______________

6) Excessive strain on a weakened heart is defined as:

____

7) What is serum cholesterol?

____

8) How do high levels of serum cholesterol change or affect the following?

a- walls of arteries ______________________________

b- size of arteries ______________________________

c- blood flow ______________________________

9) What two changes in the arteries are due to high blood pressure?

____

10) What two changes in the heart are due to high blood pressure?

____

11) Rank the following people in terms of their likelihood of developing heart disease - from the group that is least likely (1) to the group that is most likely (3)

Rank

a- lives in industrial city, is tense and gets little exercise ______

b- exercises regularly, lives in country, is relaxed ______

c- lives in industrial city, does not exercise, is relaxed ______

12) Rank the following age groups in terms of their likelihood of developing heart disease - from the group that is least likely (1) to the group that is most likely (5).

Age group	Rank
45 - 49	______
55 - 59	______
35 - 39	______
25 - 29	______
65 - 69	______

13) For every two deaths of non-smokers, how many smokers are likely to die as a result of illnesses associated with the heart? ____________

14) For every six people with high serum cholesterol concentrations in their blood, how many people with low serum cholesterol concentrations are likely to develop illnesses of the heart? ____________

15) For every 20 people who at age 60 have illnesses of the heart, how many 40 year olds are likely to have the same illnesses? ____________

16) For every 1 person who dies of cancer how many die of heart disease?

____

17) A coronary attack is more likely to occur as a result of which of the following: (check 1 or more).

a- lifelong smoking____________

b- pushing a stalled car uphill ____________

c- job interview____________

d- prolonged and regular exercise____________

18) The technical name for the heart muscle is ______________________________.

19) Speaking technically, blockage of the coronary arteries is called:

____.

20) In the table below, list in order, the degrees of damage to the heart muscle, their respective names, and their reversibility.

Degree of Damage	Name	Reversibility

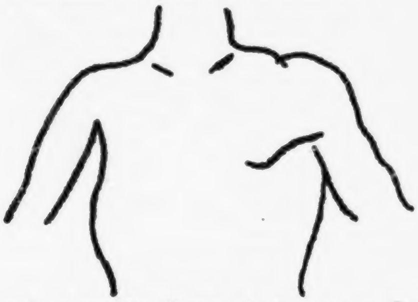
21) a) When an ECG tracing is obtained, what picks up the impulses from the heart? ____

b) The wires transmitting impulses to the ECG machine are called:

____

22) a) The tracings used in this program are from lead number? ______________

b) Indicate by a small circle, the placement of this lead.



c) The above lead records from what area of the heart? ________________

23) Draw the normal ECG tracing, labeling all of the deflections.

....

a) What deflection is sometimes present, often absent, in the normal ECG tracing?

____

24). Draw the ECG tracings associated with each type of damage to the heart muscle. Label each deflection and indicate the period of time following onset of damage at which that tracing might be recorded.

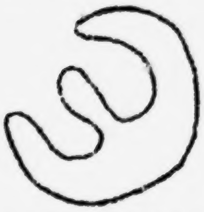
a) .... b) .... c) ....

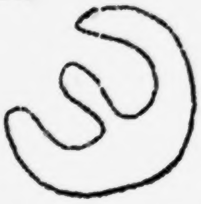
d)
time: ________________

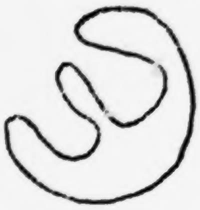
e)
time: ________________

f)
time: ________________

In each of the diagrams below, show by shading, the damage associated with the tracing directly above it.







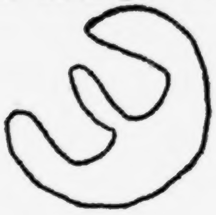
25) Draw the fully labeled ECG tracings associated with the 2 major stages of the healing process. Label each deflection and indicate the period of time following onset of damage at which that stage of healing might be recorded.

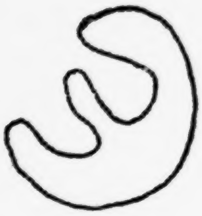
a) .... b) ....

c) time: ________________

d) time: ________________

In each of the diagrams below, show by shading, the damage associated with the tracing directly above it.





26) The deflections most indicative of muscle death are:

____

a) Describe the way these deflections change as muscle death becomes more severe.

____

27) In the healing process, name the type of damage which disappears:

a) first ______________________

b) second ______________________

28) What in the ECG tracing is unaffected by any of the changes discussed in this program?

____

29) After healing is completed, what evidence of muscle death remains in:

a) muscle ______________________________

b) tracing ______________________________

30) In terms of duration, which type of damage, by itself, is most likely to be found in medical practice?

____

Why? ______________________________

Which type of damage is least likely to be found by itself? __________

Why? ______________________________

31) What are the three requirements for a reliable diagnosis of muscle death?

a) ______________________________

b) ______________________________

c) ______________________________

APPENDIX B. Pre-test Answer Key.

Name______________________________ Date____________________

Total # of Points	
1	1. The major cause of death and physical disability in the United States is: HEART OR CORONARY DISEASE OR DISORDER
1	2. Prevalence is defined as: THE NUMBER OF CASES IN A POPULATION AT ANY GIVEN TIME (TOTAL #)
1	3. Incidence is defined as: THE NUMBER OF NEW CASES IN A POPULATION
1	4. Coronary disease is defined as a type of heart disease associated with: DISORDERS OF THE ARTERIES AROUND THE HEART
6	5. Name 6 risk factors with respect to coronary disease (any 6 of the following, 1 point each) AIR POLLUTION; HIGH SERUM CHOLESTEROL; LOW PHYSICAL ACTIVITY; AGE; SEX (MALE); ANXIETY (TENSION); LOCALE OF RESIDENCE; OCCUPATION
1	6. Approximately what percentage of deaths are due to heart disease? 50 - 60%
1	7. Overloading of the heart means: PROLONGED STRESS OR STRAIN ON THE HEART OR SUDDEN EXCESSIVE STRAIN ON AN ALREADY WEAKENED HEART.
1	8. What is serum cholesterol? CONCENTRATIONS OF FATTY SUBSTANCES IN THE BLOOD
1	9. How does level of serum cholesterol affect the arteries? THE DEPOSITS OF FATTY SUBSTANCES ON THE WALLS OF THE ARTERIES OBSTRUCT THE FLOW OF BLOOD

Total # of Points

1 10. What changes in the arteries are attributed to high blood pressure? (at least 2 = 1 point)

NARROWING OF THE ARTERIES; HARDENING OF THE ARTERIES; THICKENS THE ARTERIAL WALLS; THEY'RE LESS ELASTIC.

1 11. Complete the generalization regarding the effects of risk factors on the chance of developing coronary disease: The greater the number of risk factors, the

GREATER THE CHANCE OF DEVELOPING CORONARY (HEART) DISEASE

5 12. Rank the following age groups in terms of their likelihood of developing heart disease etc.
(1 point each correct rank)

Age group	Rank
25-29	1
35-39	2
45-49	3
55-59	4
65-69	5

1 13. For every two deaths of non-smokers, how many smokers are likely to die as a result of illnesses associated with the heart? 4

1 14. For every 6 people with high serum cholesterol concentrations in their blood, how many people with low serum cholesterol concentrations are likely to develop illnesses of the heart? 2

1 15. For every 20 people who at age 60 have illnesses of the heart, how many 40 year olds are likely to have the same illness? 3

3 16. What are three possible effects of high blood pressure on the heart?

a) Heart becomes enlarged
b) Heart muscles weakened
c) Heart receives less blood

3 17. For each of the following pairs, check the one that is more likely within each pair to develop illnesses associated with the heart or whether there is no difference between the two.

a) Week-end athlete____ Summer athlete____ No diff. ____
b) Phys. Ed. Teacher____ Elem. Ed. Teacher____ No diff. ____
c) Bank President____ Bank Clerk____ No diff. ____

APPENDIX B. Post-test Answer Key.

Ans. Points Name ____________________ Date ____________________

1) The major cause of death and physical disability in the United States is:

1 HEART DISEASE (CORONARY DISEASE OR DISORDER).

2) Prevalence of a disease is defined as:

1 NUMBER OF CASES IN A POPULATION AT ANY GIVEN TIME (TOTAL NO.).

3) Incidence of a disease is defined as :

1 THE NUMBER OF NEW CASES IN A POPULATION.

4) Coronary disease is defined as a type of heart disease associated with:

1 DISORDERS OF THE ARTERIES AROUND THE HEART (BLOOD VESSELS).

5) Name 9 risk factors with respect to coronary disease: **(1 pt. each)**

9

AIR POLLUTION (RESIDENCE)	SMOKING	AGE
SEX (MALE)	ANXIETY (TENSION)	HIGH BLOOD PRESSURE
SERUM CHOLESTEROL	LACK OF PHYSICAL ACT.	OCCUPATION OBEISITY

1 6) Excessive strain on a weakened heart is defined as :

OVERLOADING.

7) What is serum cholesterol ?

1 CONCENTRATIONS OF FATTY SUBSTANCES IN THE BLOOD.

8) How do high levels of serum cholesterol change or affect the following?

1 a- walls of arteries LINES AND/OR THICKENS THEM

1 b- size of arteries NARROWS THEM

1 c- blood flow OBSTRUCTS THE FLOW OF BLOOD

Total Points

9) What two changes in the arteries are due to high blood pressure?

1 HARDENING, NARROWING, THICKENING AND LESS ELASTICITY (ANY 2)

10) What two changes in the heart are due to high blood pressure?

1 HEART BECOMES WEAKENED A ND ENLARGED

11) Rank the following people in terms of their likelihood of developing heart disease - from the group that is least likely (1) to the group that is most likely (3)

1

	Rank
a- lives in industrial city, is tense and gets little exercise	3
b- exercises regularly, lives in country, is relaxed	1
c- lives in industrial city, does not exercise, is relaxed	2

12) Rank the following age groups in terms of their likelihood of developing heart disease - from the group that is least likely (1) to the group that is most likely (5).

1

Age group	Rank
45 - 49	3
55 - 59	4
35 - 39	2
25 - 29	1
65 - 69	5

1 13) For every two deaths of non-smokers, how many smokers are likely to die as a result of illnesses associated with the heart? ____ 4

1 14) For every six people with high serum cholesterol concentrations in their blood, how many people with low serum cholesterol concentrations are likely to develop illnesses of the heart? ____ 2

1 15) For every 20 people who at age 60 have illnesses of the heart, how many 40 year olds are likely to have the same illnesses? ____ 3

16) For every 1 person who dies of cancer how many die of heart disease?

1 3

17) A coronary attack is more likely to occur as a result of which of the following: (check 1 or more).

1

a- lifelong smoking ✓

b- pushing a stalled car uphill ✓

c- job interview ____

d- prolonged and regular exercise ____

Total Points

1 18) The technical name for the heart muscle is MYOCARDIUM.

19) Speaking technically, blockage of the coronary arteries is called:

1 OCCLUSION.

9 (3 pts. ea. row) 20) In the table below, list in order, the degrees of damage to the heart muscle, their respective names, and their reversibility.

Degree of Damage	Name	Reversibility	
1st	ISCHEMIA	ALWAYS REVERSIBLE	(YES)
2nd	INJURY	USUALLY REVERSIBLE	(YES)
3rd	INFARCTION	NOT REVERSIBLE	(NO)

21) a) When an ECG tracing is obtained, what picks up the impulses from the

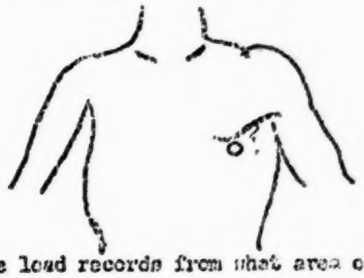
1 heart? ELECTRODES

b) The wires transmitting impulses to the ECG machine are called:

1 CHEST LEADS OR PRECORDIAL LEADS

1 22) a) The tracings used in this program are from lead number? 5

b) Indicate by a small circle, the placement of this lead.

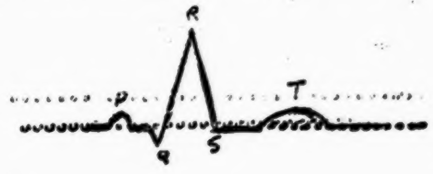


(Credit any circle under line)

1 c) The above lead records from what area of the heart? ANTERIOR

23) Draw the normal ECG tracing, labeling all of the deflections.

9 (tracing=8, labels=1)



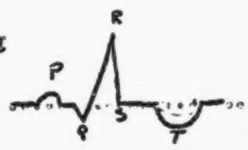
ABCDEFHJL

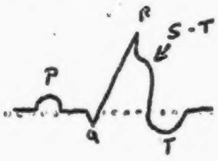
1 a) What deflection is sometimes present, often absent, in the normal ECG tracing? S

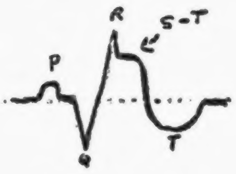
ABCDEFHKL [illegible] [illegible]

9 pts. each tracing

(tracing=8
labeling=1)

a) 

b) 

c) 

1 pt. each

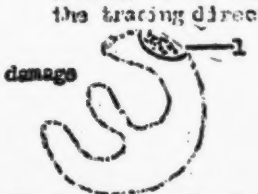
d. time: IMMEDIATELY

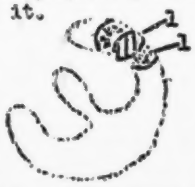
e. time: SEVERAL MINUTES

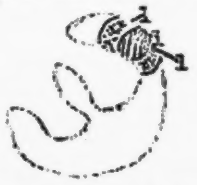
f. time: SEVERAL HOURS OR DAYS

In each of the diagrams below, show by shading, the damage associated with the tracing directly above it.

1 pt. each damage





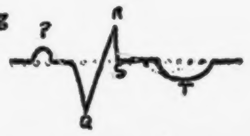


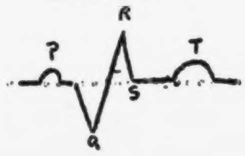
25) Draw the fully labeled ECG tracings associated with the 2 major stages of the healing process. Label each deflection and indicate the period of time following onset of damage at which that stage of healing might be recorded.

ABCDEGHKL ABCDEGHJL

9 pts. each tracing

(tracing=8
labeling=1)

a) 

b) 

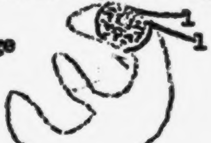
1 pt. each

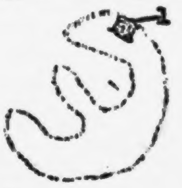
c. time 3 WEEKS - SEVERAL MONTHS

d. time SEVERAL MONTHS - YEARS

In each of the diagrams below, show by shading, the damage associated with the tracing directly above it.

1 pt. each damage





1 26) The deflections most indicative of muscle death are:
Q and R

1 a) Describe the way these deflections change as muscle death becomes more severe
Q AND R WAVES BOTH GET DEEPER

Total Points

1 27) In the healing process, name the type of damage which disappears:

a) first INJURY

1 b) second ISCHEMIA

1 28) What in the ECG tracing is unaffected by any of the change discussed in this program? P WAVE

29) After healing is completed, what evidence of muscle death remains in:

1 a) muscle THE INFARCTION SCAR

1 b) tracing INCREASED Q WAVE, DECREASED R WAVE, INVERTED T WAVE

1 30) In terms of duration, which type of damage, by itself, is most likely to be found in medical practice? INFARCTION

1 why? IT LASTS THE LONGEST AND IS NOT REVERSIBIE

1 Which type of damage is least likely to be found by itself? ISCHEMIA

1 why? PATTERN RECEDES VERY QUICKLY OR BECOMES INJURY

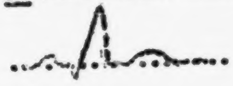
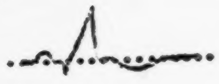
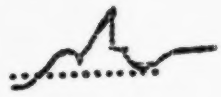
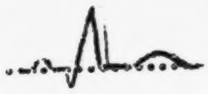
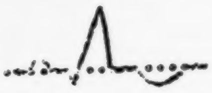
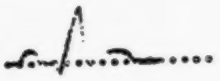
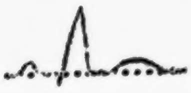
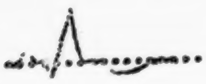
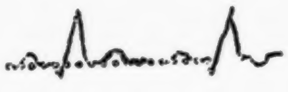
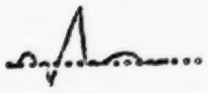
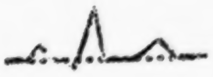
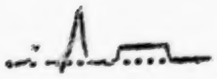
1 31) What are the three requirements for a reliable diagnosis of muscle death?

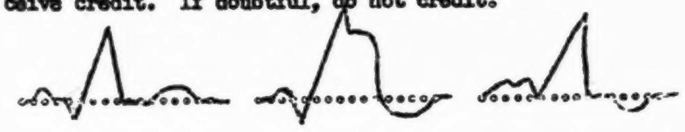
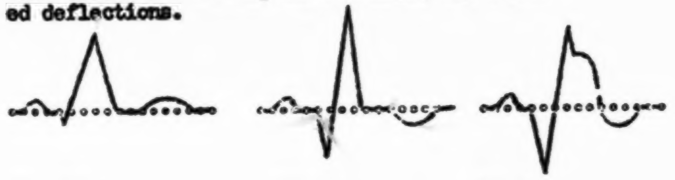
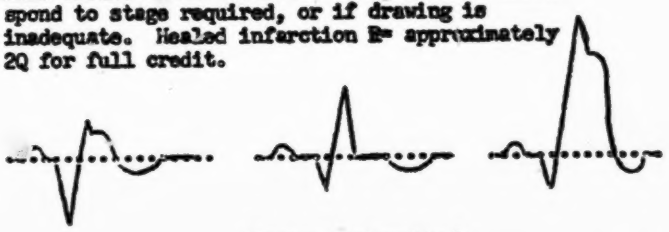
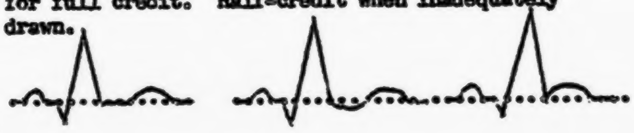
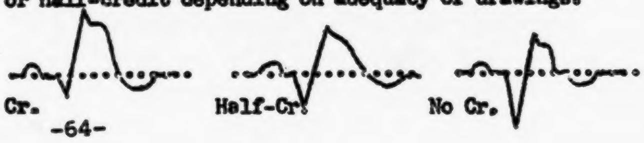
a) SERIAL TRACINGS

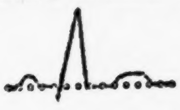
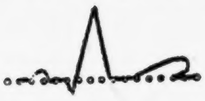
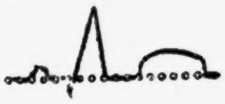
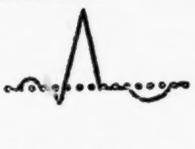
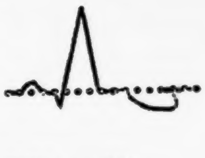
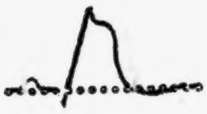
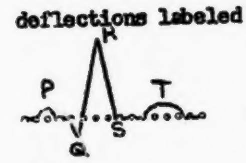
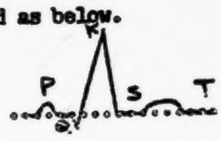
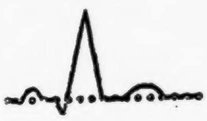
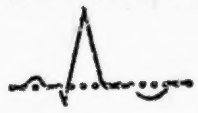
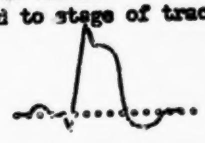
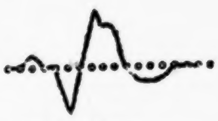
1 b) TOTAL CLINICAL PICTURE

1 c) LOCALIZATION OF DAMAGE

APPENDIX B. ECG Tracing Scoring Criteria.

Letter	Part of Tracing	Stage	Criterion
A	Common Base Line	all	Deflections in the tracing should be from a common base line, whether dotted (......) base line provided for tracing is used or not. No half credit allowed.
		Examples	 Credit  Credit  No credit
B	P/Q and S/T segments	all	The length of the PQ segment should be perceptibly smaller than the length of the ST segment. If doubtful, compare the amount of dots on the provided line covered, by each segment, or measure along an edge of paper. No half credit allowed)
		Examples	 Credit  Credit  No credit
C	P wave narrower more acute than T (inverted or not)	all	Differences should be easily discernible. If straight line T in recovering ischemia is drawn and no indication of T is given, the size of the whole segment should be larger to receive credit.
		Examples	 Credit  Credit  No credit
D	P/T waves rounded	all	P and T waves are always rounded, whether inverted or not. In straight line, recovering ischemia, credit if P alone is rounded.
		Examples	 Credit  NO Credit  No credit

Letter	Part of Tracing	Stage	Criterion
E	P/Q segment	Normal ischemia injury	Must be a distrinct "shelf" parallel to or on the baseline between P wave and Q depression to receive credit. If doubtful, do not credit.
		Examples	 Credit No credit No credit
F	R/Q	normal ischemia injury	Full credit, R= 3-6 Q. Half credit, R= 2-3 Q. No credit for any other proportion. Half credit for inadequate drawings, eg. rounded deflections.
		Examples	 (R= 6Q) Full credit (R= 3Q) Half credit (R= Q) No credit
G	Q/R	infarction	Full credit R= less than 2Q to R= Q. Half credit R= 2-3Q Half credit if infarction tracing doesn't correspond to stage required, or if drawing is inadequate. Healed infarction R= approximately 2Q for full credit.
		Examples	 Credit (Healed infarction) Credit (R=2Q) No credit
H	BST	Normal ischemia healed infarction	ST segment clearly on baseline, when appropriate for full credit. Half-credit when inadequately drawn.
		Examples	 Credit Half-credit No credit
I	EST	injury	Elevated ST segment, in injury, drawings. Full or half-credit depending on adequacy of drawings.
		Examples	 Cr. Half-Cr. No Cr.

Letter	Part of Tracing	Stage	Criterion
J	T wave convex	normal	Full or half credit depending on adequacy or drawing and appropriateness to type of tracing. If normal T not correct, no credit. Curve rises and returns to baseline which continues slightly beyond wave in models.
		Examples	 Full Credit  Half credit  Half credit
K	T wave concave	ischemia	Curve starts from and returns to baseline, and is approximately same width as normal T wave. Different stages of ischemia differ in depth of curve. Full or half credit for adequacy of drawing, when inverted T indicated.
		Examples	 Full Credit  Half-credit  Half-credit
L	labeling	all	deflections labeled as below.
		Examples	 Credit  No credit  No credit
N	Name	all	Name must correspond to stage of tracing.
		Examples	 ischemia  injury  infarction
R	reversibility	all	Ischemia is reversible. Injury is usually reversible. Infarction is not reversible.

If P wave inverted no credit for either C or D above.

If line doesnt extend beyond ½, credit for J and K.

APPENDIX C. Specific Attitude Scales.

Name____

Please answer the following questions on the back of the answer sheet used for the Habit Survey, beginning with itme 201. Answer the following questions in terms of how you felt about the program you have just taken. Indicate your feelings by marking on the answer sheet the number of the choice which most closely reflects your opinion.

201. How did you feel about the way the material was presented?
    1. Enjoyed presentation.
    2. Presentation was moderately pleasant.
    3. Presentation was moderately unpleasant.
    4. Disliked presentation.

202. Would you like to learn other subjects by the same format?
    1. Definitely.
    2. Probably.
    3. Probably not.
    4. Definitely not.

203. Did you feel that this format made it easier for you to learn the subject?
    1. Definitely.
    2. Probably.
    3. Probably not.
    4. Definitely not.

204. Do you feel that this format helped you learn the material more rapidly than you would have learned it from a textbook?
    1. Definitely.
    2. Probably.
    3. Probably not.
    4. Definitely not.

205. Did you feel more certain about knowing the subject matter than you would have if it were presented in a textbook?
    1. Definitely.
    2. Probably.
    3. Probably not.
    4. Definitely not.

206. Did you feel that the format helped you to concentrate on the material more than you would have been able to in a textbook?
    1. Definitely.
    2. Probably.
    3. Probably not.
    4. Definitely not.

Go on to the next page.

Please answer each of the following questions in terms of how interested you would be in learning more about the subject referred to in the question. Use the following scale to express your opinion by recording the appropriate number on the answer sheet.

1. Definitely interested	3. Not too interested.
2. Somewhat interested.	4. Definitely uninterested.

Would you like to learn more about

207. ......the principles of programed instruction?

208. ......the relationship of risk factors to heart disease?

209. ......other risk factors?

210. ......the incidence and prevalence of heart disease?

211. ......degree of damage to the heart?

212. ......reversibility of heart damage?

213. ......medical terminology related to heart disease?

214. ......interpreting ECG trancings?

215. ......the effect of damage on the heart muscle, as represented in the program by the drawings with shading?

216. .....the healing cycle in heart disease?

APPENDIX C. Habit Survey.

Each of the questions below describes how people react in a particular situation. We would like to know how true each of these reactions is for you, how similar it is to the way you react. There are no right or wrong answers, since people's habits differ a good deal. We would just like to know what your reactions in these situations are. Each question has five possible answers.

5 stands for always true of me.

4 stands for true of me a lot of the time.

3 stands for true of me ½ the time.

2 stands for not true of me a lot of the time.

1 stands for never true of me.

Mark your answers on the enclosed answer sheet. Be sure to note that the spaces go across the page, and then down. From time to time, check to see that the number of the space in which you are marking your answer, is the same as the question number.

1. My collection of books (or records, magazines, etc.) is arranged according to some plan.

2. Faced with a boring job, I notice all the other things around me that I could be doing.

3. Before tuning in to a TV program I look at a newspaper, or program guide to see if it is likely to be worthwhile.

4. The more important the exam or test, the better I seem to do.

5. I automatically double-check the traffic light both in my direction, and in the other direction.

6. Time pressure on an exam causes me to do worse than the rest of the group under similar conditions.

7. I like to check the spelling of a word with which I am not too familiar.

8. While I may (or may not) be nervous before taking an exam, once I start, I seem to forget to be nervous.

9. I don't bother to look up the calendar to make sure I have the right date.

10. Doing cross word puzzles is boring.

11. In courses in which the total grade is based mainly on one exam, I seem to do better than other people.

12. I am (or would be) uncomfortable driving when the indicator shows less than ¼ tank of gasoline left.

5 stands for always true of me.

4 stands for true of me a lot of the time.

3 stands for true of me $\frac{1}{2}$ the time.

2 stands for not true of me a lot of the time.

1 stands for never true of me.

13. I find that my mind goes blank at the beginning of an exam, and it takes me a few minutes before I can function.

14. While reading a textbook, I am not distracted by the activities of others until I have finished.

15. I do not consult a book's index.

16. I don't bother to count the small change I get after buying something.

17. I can work at one thing for a long time with relatively little effort.

18. When I am poorly prepared for an exam or test, I get upset, and do less well than even my restricted knowledge should allow.

19. Once I lock a door, I don't check it.

20. My mind does not wander while listening to a conversation.

21. I don't keep track of my weight.

22. When I pass a large clock, or electric time signal, I generally compare my own watch to it.

23. In a course where I have been doing poorly, my fear of a bad grade cuts down my efficiency.

24. I often find that I forgot to take enough pocket money for the day.

25. When I leave my home I generally look up at the windows (or would if I could) to see whether the lights were turned off.

26. I look forward to exams.

27. When I get a new calendar I mark down the birthdays, or anniversaries, of peopl I care about.

28. I check whether the gas (water, electricity, etc...) is turned off before going to sleep.

29. I feel a great sense of relief when I find an excuse to take me away from my work.

5 stands for always true of me.

4 stands for true of me a lot of the time.

3 stands for true of me ½ the time.

2 stands for not true of me a lot of the time.

1 stands for never true of me.

30. Although "cramming" under pre-examination tension is not effective for most people, I find that if the need arises, I can retain the "crammed" materials for use on a test.

31. I check the location of tickets after I leave the box office.

32. I keep track of the books I lend.

33. When I start a test, nothing is able to distract me.

34. I avoid unfamiliar neighborhoods.

35. Being without my wristwatch is very uncomfortable.

36. Working on an adding machine every now and then is fun.

37. I have difficulty in maintaining concentration for long periods of time.

38. I enjoy taking a difficult exam more than an easy one.

39. When I try to find a particular article in a popular magazine, I tend to leaf through the issue rather than consult the table of contents.

40. Even if I have a road map I don't (or wouldn't) stop worrying about having made a wrong turn-while driving in an unfamiliar area-until I see a road sign.

41. The time taken to prepare an outline of a subject could be more effectively spent in other ways.

42. Nervousness while taking an exam or test prevents me from doing well.

43. When I get a phone number from "information", I jot it down so as not to forget it by the time I dial the number.

44. During a speech, meeting, or lecture, I often "come to" realizing that I have not heard a word the speaker was saying.

45. I do not check my schedule once a routine has been established.

46. I generally have the right change handy for a phone booth, parking meter, or toll gate.

47. Nervousness while taking a test helps me to do better.

48. I wouldn't (or don't) mind the work of a bookkeeper.

5 stands for always true of me

4 stands for true of me a lot of the time.

3 stands for true of me ½ the time.

2 stands for not true of me a lot of the time.

1 stands for never true of me.

49. When I finish a long division, I multiply the result by the divisor to see whether I got the right answer.

50. While reading, I find that 2-3 pages have passed without my being able to recall a thing I read.

51. Having copies of correspondence is not worth the effort involved.

52. Even though it is often possible to figure out word meanings from the context, I wouldn't use such a word in conversation until I've looked it up.

53. During exams or tests, I block on questions to which I know the answers, even though I remember as soon as the exam is over.

54. I am annoyed by invitations which do not include the specific time when I am expected.

55. I am not easily distracted.

56. My calendar is frequently a month or two behind the actual date.

57. I am so tired from worrying about an exam, that I find I almost don't care how well I do by the time I start the test.

58. Putting things in their proper place, so that they can easily be found, is terribly boring.

59. The more important the examination, the less well I seem to do.

60. Even if I had to, it would be impossible for me to keep track of the number of calories in my diet.

61. When I don't do well on a difficult item at the beginning of an exam, it tends to upset me so that I block on even easy questions later on.

62. I would not pay to have a watch fixed which is two or three minutes slow.

63. I work most effectively under pressure, as when the task is very important.

64. Busdrivers should be required to call out the location of stops.

65. During a lecture or speech, my mind often wanders.

66. I find myself reading exam questions without understanding them, and I must go back over them so that they will make sense.

For the next set of questions each item consists of a pair of alternatives numbered 1 or 2. Please select the one statement of each pair (and only one) which you strongly believe to be the case as far as you are concerned.

Be sure to select the one you actually believe to be more true rather than the one you think you should choose or the one you would like to be true. This is a measure of personal belief: obviously there are no right or wrong answers.

In some instances, you may discover that you believe both statements or neither one. In such cases, be sure to select the one you more more strongly believe to be the case as far as you're concerned. Also try to respond to each item independently when making your choice; do not be influenced by your previous choices.

Please answer these items carefully but do not spend too much time on any one item. Be sure to find an answer for every choice. Find the number of the item on the answer sheet and black-in the space under the number 1 or 2 which you choose as the statement most true.

REMEMBER

Select that alternative which you personally believe to be more true.

I more strongly believe that:

67- 1. Children get into trouble because their parents punish them too much.
    2. The trouble with most children nowadays is that their parents are too easy with them.

68- 1. Many of the unhappy things in people's lives are partly due to bad luck.
    2. People's misfortunes result from the mistakes they make.

69- 1. One of the major reasons why we have wars is because people don't take enough interest in politics.
    2. There will always be wars, no matter how hard people try to prevent them.

70- 1. In the long run people get the respect they deserve in this world.
    2. Unfortunately, an individual's worth often passes unrecognized no matter how hard he tries.

71- 1. The idea that teachers are unfair to students is nonsense.
    2. Most students don't realize the extent to which their grades are influenced by accidental happenings.

72- 1. Without the right breaks one cannot be an effective leader.
    2. Capable people who fail to become leaders have not taken advantage of their opportunities.

73- 1. No matter how hard you try some people just don't like you.
    2. People who can't get others to like them, don't understand how to get along with others.

74- 1. Heredity plays the major role in determining one's personality.
    2. It is one's experiences in life which determine what they're like.

75- 1. I have often found that what is going to happen will happen.
    2. Trusting to fate has never turned out as well for me as making a decision to take a definite course of action.

I more strongly believe that:

76- 1. In the case of the well prepared student there is rarely if ever such a thing as an unfair test.
   2. Many times exam questions tend to be so unrelated to course work, that studying is really useless.

77- 1. Becoming a success is a matter of hard work, luck has little or nothing to do with it.
   2. Getting a good job depends mainly on being in the right place at the right time.

78- 1. The average citizen can have an influence in government decisions.
   2. This world is run by the few people in power, and there is not much the little guy can do about it.

79- 1. When I make plans, I am almost certain that I can make them work.
   2. It is not always wise to plan too far ahead because many things turn out to be a matter of good or bad fortune anyhow.

80- 1. There are certain people who are just no good.
   2. There is some good in everybody.

81- 1. In my case getting what I want has little or nothing to do with luck.
   2. Many times we might just as well decide what to do by flipping a coin.

82- 1. Who gets to be the boss often depends on who was lucky enough to be in the right place first.
   2. Getting people to do the right thing depends upon ability, luck has little or nothing to do with it.

83- 1. As far as world affairs are concerned, most of us are the victims of forces we can neither understand, nor control.
   2. By taking an active part in political and social affairs the people can control world events.

84- 1. Most people don't realize the extent to which their lives are controlled by accidental happenings.
   2. There really is no such thing as "luck".

85- 1. One should always be willing to admit his mistakes.
   2. It is usually best to cover up one's mistakes.

86- 1. It is hard to know whether or not a person really likes you.
   2. How many friends you have depends upon how nice a person you are.

87- 1. In the long run the bad things that happen to us are balanced by the good ones.
   2. Most misfortunes are the result of lack of ability, ignorance, laziness, or all three.

88- 1. With enough effort we can wipe out political corruption.
   2. It is difficult for people to have much control over the things politicians do in office.

89- 1. Sometimes I can't understand how teachers arrive at the grades they give.
   2. There is a direct connection between how hard I study and the grades I get.

I more strongly believe that:

90- 1. A good leader expects people to decide for themselves what they should do.
2. A good leader makes it clear to everybody what their jobs are.

91- 1. Many times I feel that I have little influence over the things that happen to me.
2. It is impossible for me to believe that chance or luck plays an important role in my life.

92- 1. People are lonely because they don't try to be friendly.
2. There's not much use in trying too hard to please people, if they like you, they like you.

93- 1. There is too much emphasis on athletics in high school.
2. Team sports are an excellent way to build character.

94- 1. What happens to me is my own doing.
2. Sometimes I feel that I don't have enough control over the direction my life is taking.

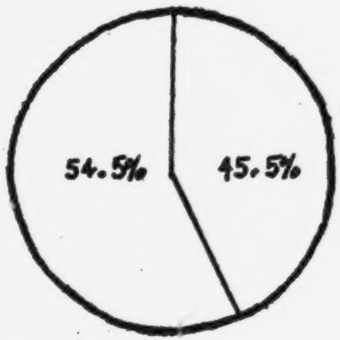
95- 1. Most of the time I can't understand why politicians behave the way they do.
2. In the long run the people are responsible for bad government on a national as well as on a local level.

APPENDIX D. Constructed Response Answer Booklet.

NAME ______________________________ #________

1. ____________

2.



3. ____________

4. ____________

5. ________ ________

6. ____________

7. ____________ _____

8. ________ ________

9. ____________

10. ____________ ____________

11. ______________ ______________

12. ______________

13. ______________

14. ____________________________

15. ______________ ______________

16. ______________

17. ______________

18. ______________ ______________

19. ____________________________ ___________ing

20. ______________ ______________

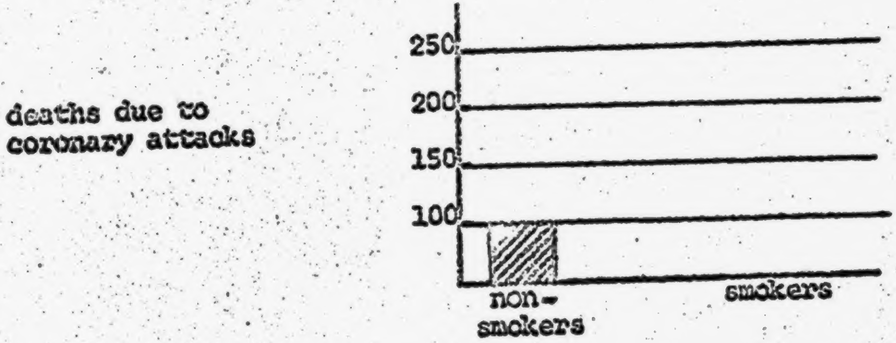
21. ______________

22. ______________

23. ____________________________

24. ______________________________

25.



26. ______________ ______________

27. ______________

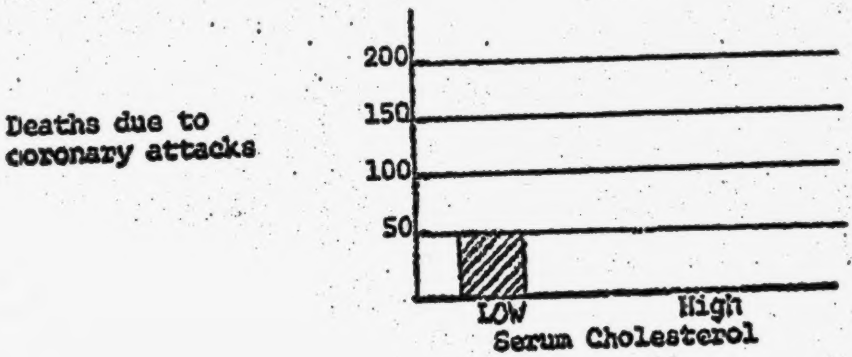
28. ______________

29. ______________

30. ______________ ______________

31. ______________

32.



33. ____________ ____________ ____________

34. ____________

35. ____________

36. ____________ ____________ ____________

37. ____________ ____________

38. ____________

39. ____________ ____________

40. ____________ ____________

41. ____________

42. ____

43. ____________ ____________s

44. ____________

45. ______ ______ ______

46. ______

47. ______

48. ______

49. ______

50. ______ ______

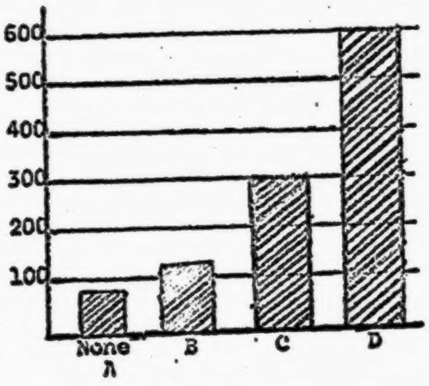
51. ______

52. ______

53. ______

54. ______

Risk Factors
high serum cholesterol
high blood pressure
smoking



55. __________ __________

56. __________

57. __________ _____cardial

58. __________

59. _____ _______ _______

60. __________ __________ __________

61. __________ __________

62. __________

Degree of Damage	Name of Damage
1st	
2nd	injury
3rd	

63. __________ _______ __________

64. ____________

Degree of Damage	Name of Damage

65. ____________ ________________ ____________

66. ____________ ____________

67. ____________ ____________

Degree	Name	Reversibility
1st		
2nd		
3rd		

68. electrical ______________
heart ______________
record ______________

69. ____________________ _ _ _ ____________

70. ____________ ____________ __________

71. ______ ______ ______

72. ______ ______ ______ ______

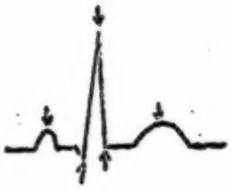
73. ______ ______ ______ ______

______

74. ______ ______ ______ ______

75. ______

76.



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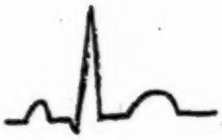
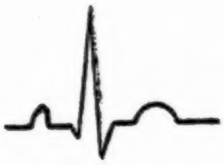
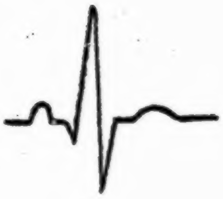


1

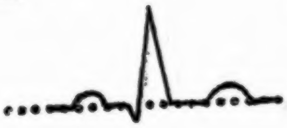


2



3

78.

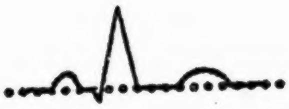


(base line)

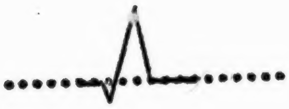
79. ____________ ____

80. ____

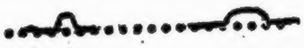
81. ______________________



82.



83.



84. .... (base line)

85. ____________ ____________

86. ____

87. ____________ __________

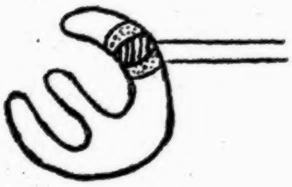
88. (Ischemia) .... (Normal)

89.

90. ____

91. ____________ ____________

92.

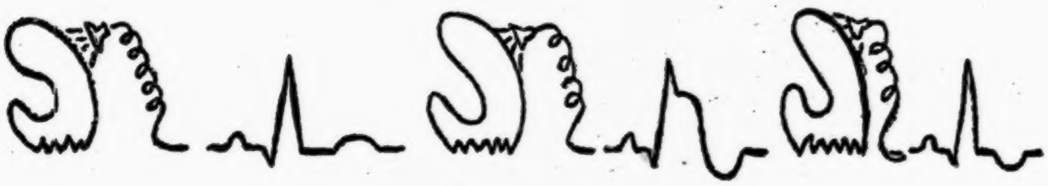


93. ____

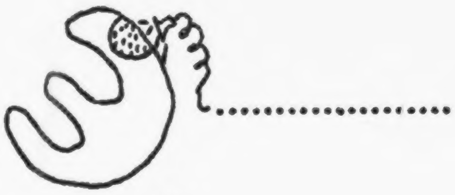
94. ____________ ____________

95. .... (normal) .... (injury)

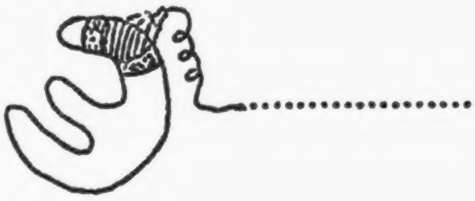
96.



97.



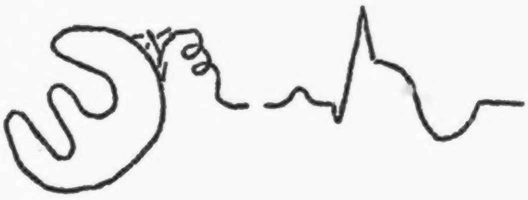
____

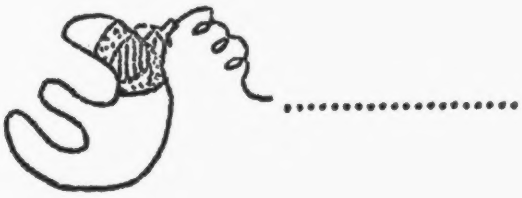


____

98. ______________ ______________

99.

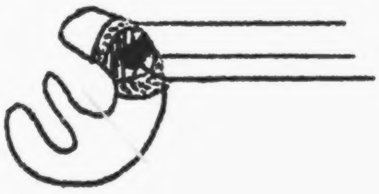


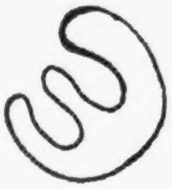


100.

101. ______________ ______________ ______________ ______________

102.



103. 

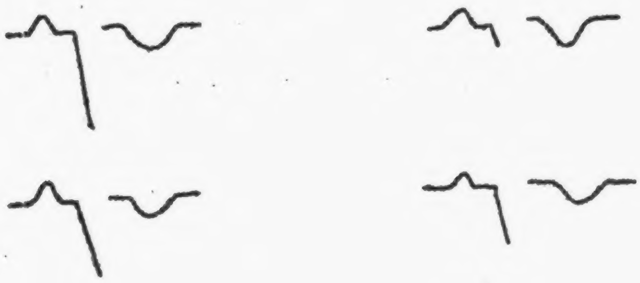
104. ____

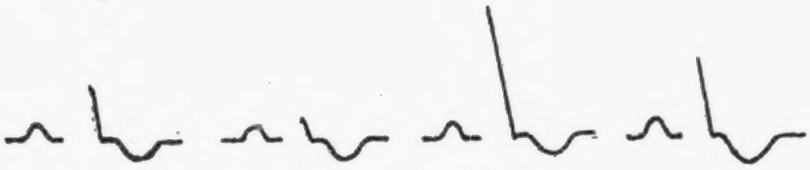
105. ___________

106.

....

107. ____________ ____________ ____________ ________ ______ ________

108. 

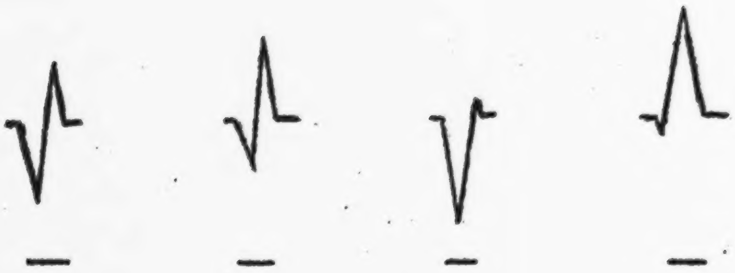
109. 

110.

....

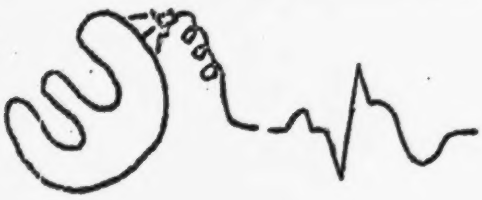
111. ___________, or ___________. ___________

112.



113. ____________________ ____________________ ____________________

114.



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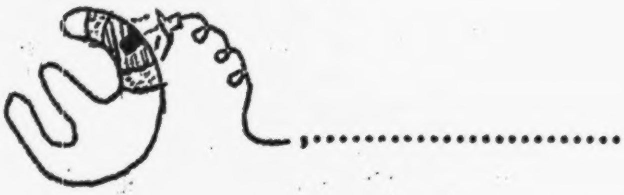

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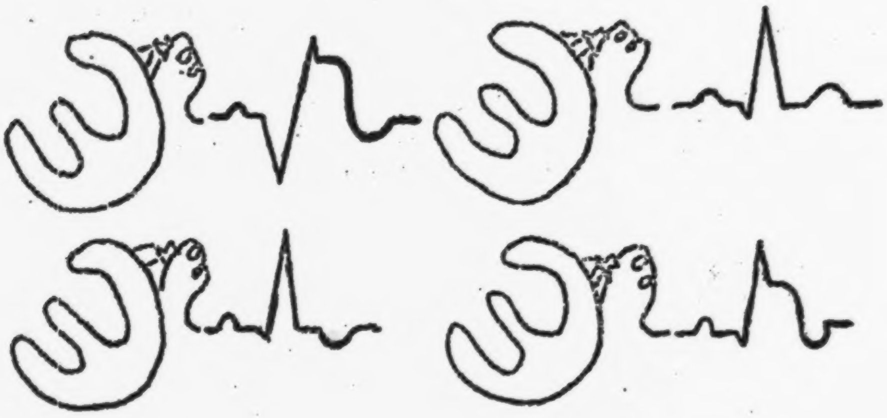

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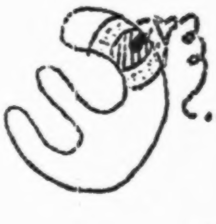
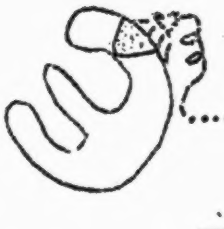
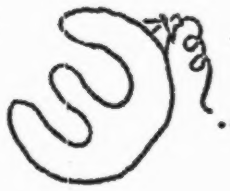
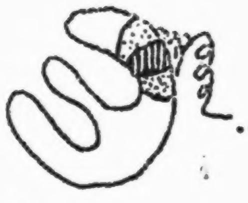
 ....

 ....

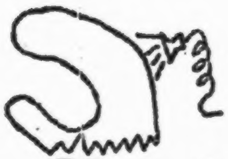
________________ ________________

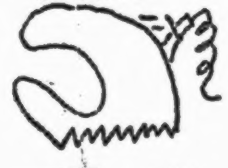
 ....

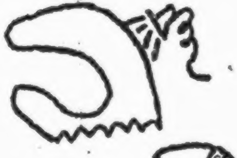
 ....

________________ ________________

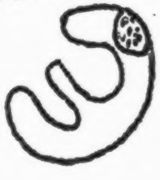
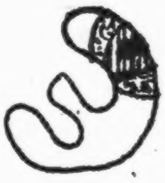
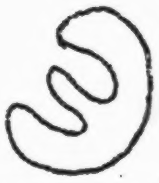
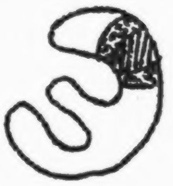
118.

 .... ________________

 .... ________________

 .... ________________

119.

— — — —

120 ________________ ________________

121. __________ ______________________
__________, or __________

122. ____

123. __________ __________ and __________

124. ________________ ______________

125. ________________

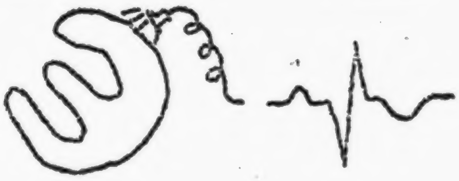
126. __________ ______________________________

127. ________________

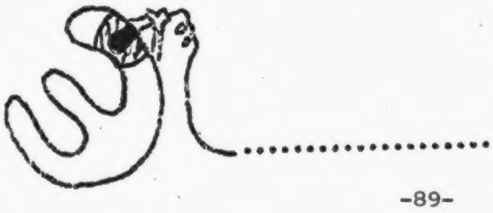
128. __________ __________

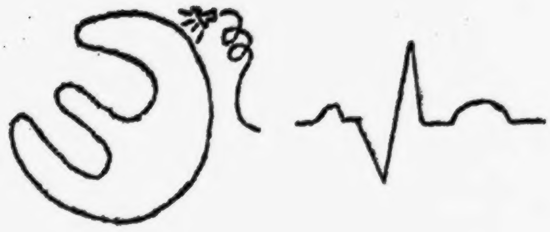
129. __________ __________

130.



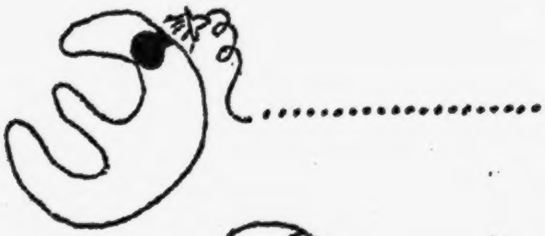
131.

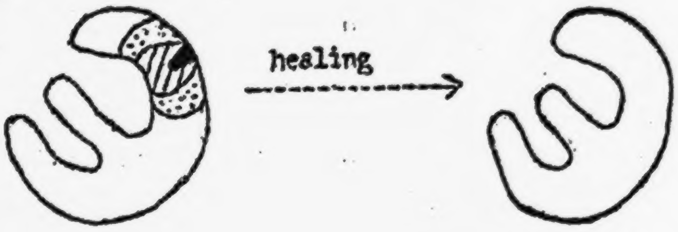


132. 

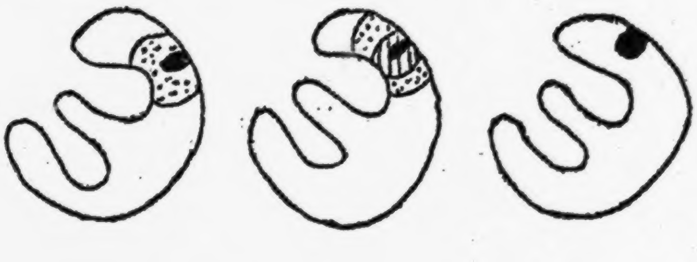
133. ____________

134. ______________________________________

135. 

136. 

137. __________, the __________, and the __________

138. 

___ ___ ___

139. __________ __________

140. ____

141 [redacted]

142. [redacted]

143. [redacted]

Appendix D. Constructed Response Version

INSTRUCTIONS

The material presented here is in the form of an instructional, teaching machine, program and deals with heart disease and its diagnosis.

The material is presented in a series of items or frames, each of which requires you to give one or more answers. After you have written your answer(s) on the answer sheet provided, check it by turning to the next page. The correct answer appears in the left-hand margin next to the succeeding item. The subject matter is so organized that you must go from page to page. Do not read down the page.

In order to get maximum benefit from this program, do not check the answer until you have recorded your response.

Please follow this sequence:

1. Turn to page 1 and read item 1.
2. Record your answer in the answer sheet provided for this purpose.
3. After recording your response, turn to page 2 and check it.
4. Now read frame 2, record your response, and check it on page 3.
5. Follow this procedure for the succeeding items.
6. When you have finished, return your booklet and answer sheet, and you will receive a test on the material.
7. If you have any questions, raise your hand and someone will come over to help you.

1

Heart disease causes more than half of all deaths in the U.S. Consequently, less than _____ of all deaths are due to other causes.

Please turn to next page

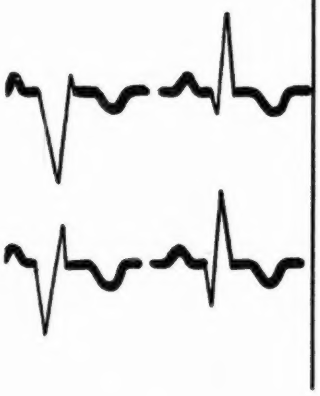
D

55

Risk factors increase the probability of developing a variety of heart impairments. One such impairment is myocardial infarction which refers to damage of the heart muscle, or myocardium.

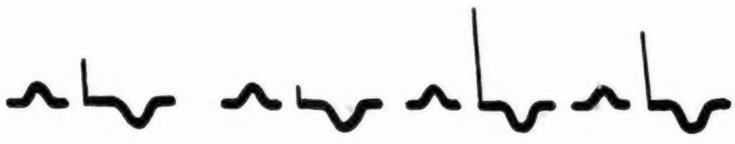
Which part of the word "myocardium" means heart?________

Which part means muscle?_________



109

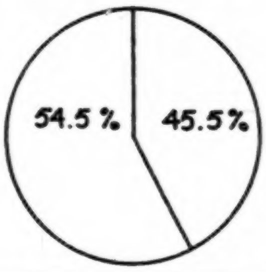
Draw the Q wave you would expect in each case.



half

2

Nearly 55% of all deaths, more than the total of all other causes combined, are due to heart disease.
Label the section that represents deaths resulting from heart diseases (A), and deaths from all other causes (B).

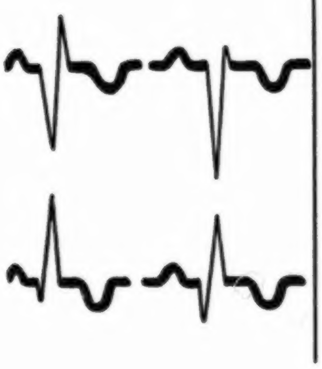


Please turn to next page

Cardium means heart
Myo means muscle

56

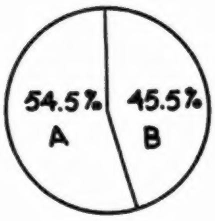
Prolonged blockage, or occlusion, of a coronary blood vessel causes irreversible damage to the heart muscle, otherwise known as the_____________.



110

The enlarged Q wave may not appear until several hours or days after the initial occlusion of the blood vessel. Draw the tracing you might expect three days after an occlusion.

____



3

Heart disease accounts for three times as many deaths as all kinds of cancer put together.

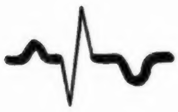
For every death caused by cancer__________are caused by heart diseases.

Please turn to next page

Myocardium

57

Blockage, or what is technically known as __________, of the coronary blood vessel results in__________cardial infarction.



111

The Q wave becomes enlarged within______________, or ______________after onset of an occlusion. In general, the larger the Q wave, the_________severe the damage.

4

three (3)

In addition to being the major cause of death in the U.S., heart disease is also considered to be the major cause of disability. This means that heart disease causes_______disability than any other disease.

Please turn to next page

58

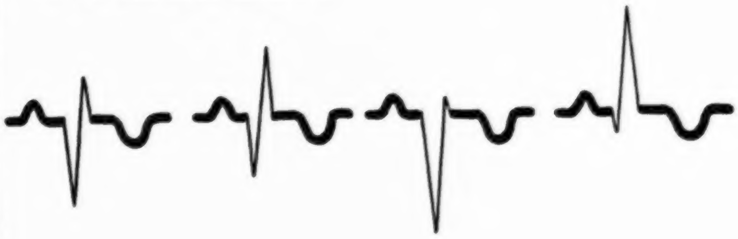
Occlusion
Myocardial

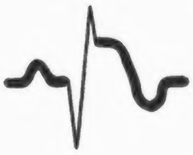
The occlusion of a coronary blood vessel leads to myocardial destruction, technically known as myocardial __________.

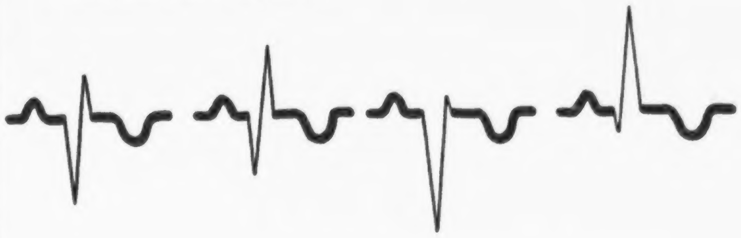
112

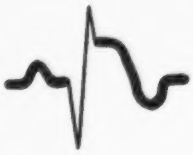
several hours (or days)
days (or hours)
more

Number the tracings below in order of increasing severity of mycordial infarction (1 for the least severe 4 for the most severe).



	5
more	More than half of the deaths and serious disabilities in the U.S. are due to__________ ____________.
	59
Infarction	Damage due to occlusion of a coronary blood vessel is categorized in terms of severity of damage. There are three degrees of damage: 1st degree damage 2nd degree damage ___ _____ _____
	113
3 2 4 1	The tracing shown below combines the patterns characteristic of 3 types of damage. What types of damage might account for this tracing?  ____________________ ____________________ ____________________

three (3)	4 In addition to being the major cause of death in the U.S., heart disease is also considered to be the major cause of disability. This means that heart disease causes_______disability than any other disease. Please turn to next page
Occlusion Myocardial	58 The occlusion of a coronary blood vessel leads to myocardial destruction, technically known as myocardial __________.
several hours (or days) days (or hours) more	112 Number the tracings below in order of increasing severity of mycordial infarction (1 for the least severe 4 for the most severe). 

more	5 More than half of the deaths and serious disabilities in the U.S. are due to__________ __________.
Infarction	59 Damage due to occlusion of a coronary blood vessel is categorized in terms of severity of damage. There are three degrees of damage: 1st degree damage 2nd degree damage ___ _____ _____
3 2 4 1	113 The tracing shown below combines the patterns characteristic of 3 types of damage. What types of damage might account for this tracing?  __________ __________ __________

heart disease

6

Prevalence is a term used to refer to the total number of cases of a disease present in a population at one time. The statistics given previously indicate that heart disease is very_________t in our society.

3rd degree damage

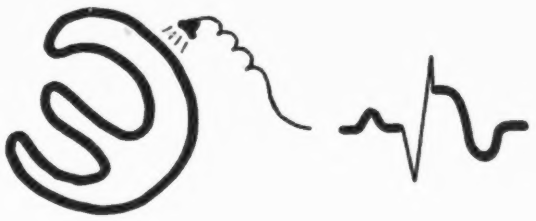
60

The three degrees correspond to the severity of damage to the heart muscle. Damage of the first degree is the______severe, while damage of the _ ____ _______is the most severe.

A combination of ischemia, injury and infarction.

114

Indicate by shading the type of damage that would account for the tracing.



prevalent

7

The number of cases of heart disease in the U.S. in 1964 was 3.125 million; 1.945 million men and 1.180 women.

These figures suggest that heart disease is more__________among_______than it is among women.

---

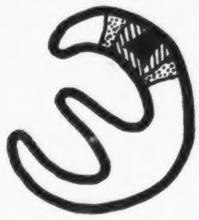
least
third degree

61

Infarction is the most severe, or__________ degree damage, and involves muscle death.

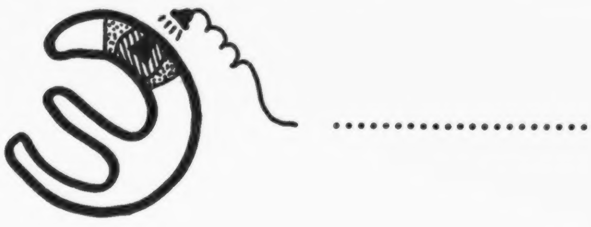
Fill in the missing term

Degree of damage	Name
1st	ischemia
2nd	injury
3rd	__________



115

Draw the tracing you would expect.



prevalent
men

8

FATAL HEART ATTACK RATE IN THE UNITED STATES

Age Group	Men	Women
30-39 years	49 per 100,000	11 per 100,000
40-49 years	180 per 100,000	47 per 100,000
50-59 years	610 per 100,000	191 per 100,000
60-69 years	1211 per 100,000	535 per 100,000

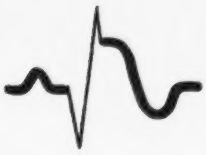
Examination of the table indicates that in addition to having a higher incidence of heart disease, the incidence of fatalities due to heart attacks is also higher among_______than it is among__________.

3rd degree damage
infarction or muscle
death

62

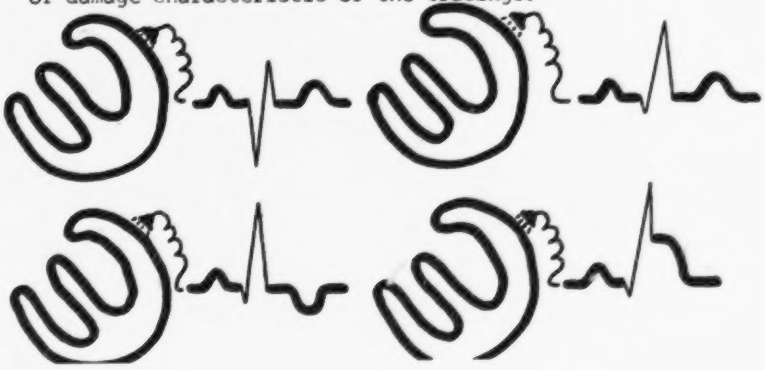
The least severe damage is called ischemia. Ischemia is damage of the__________degree, and is reversible. Complete the table below:

Degree of Damage	Name of Damage
1st	
2nd	injury
3rd	



116

In each diagram, indicate by shading, the type of damage characteristic of the tracings.



men
women

9

The number of new cases of a disease developing in a population during a period of time is called "incidence."

AGE	New cases of coronary disease per thousand
40	3
60	20

In the table above the greatest__________of coronary disease is at age 60.

1st degree

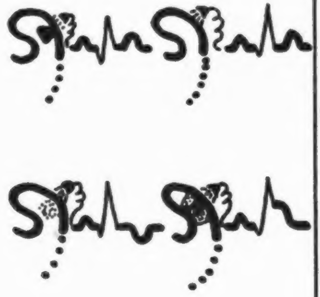
ischemia
injury
infarction

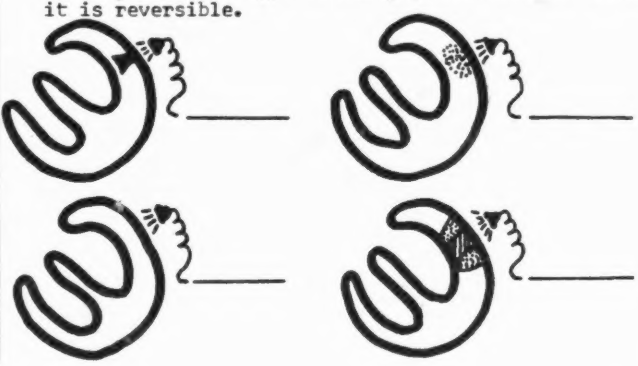
63

The first effect of an_________of the coronary blood supply is______degree damage, or_______.

117

For each lead draw the type of tracing one might obtain, name the type of damage, and indicate whether it is reversible.





incidence

10

AGE	New Cases per 1000
40	3
60	20

The table above suggests that the__________of heart disease is low at younger ages, and high at ______________ages.

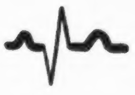
---

occlusion
first
ischemia

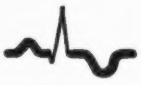
64

"Injury" is the name for damage which is of intermediate severity. So "injury" would be_____degree damage. Complete the table:

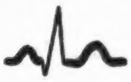
Degree of Damage	Name of Damage



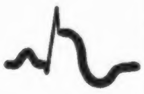
not
reversible
infarction



reversible
ischemia

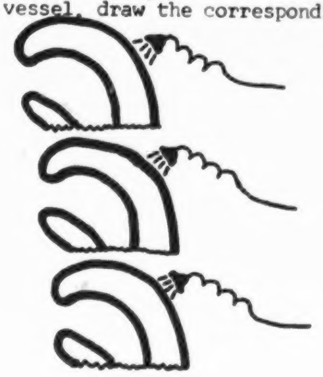


normal



usually
reversible
injury

Show three successive stages of myocardial damage, as they accumulate, due to occlusion of a coronary blood vessel, draw the corresponding tracings and name them. 118



____

____

____

incidence
older

11

The difference between prevalence and incidence is that__________is a term that refers to the total number of cases of a disease in a population at one time while___________refers to the number of new cases of a disease developing at a specific time.

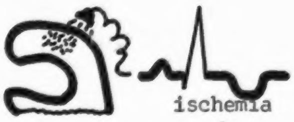
2nd

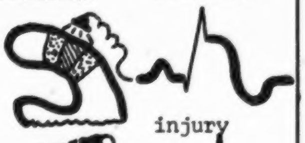
1st ischemia
2nd injury
3rd infarction

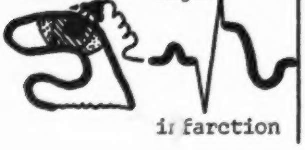
65

What will happen to the affected area right after ischemia if the blood supply is not restored?

________ ________ ________

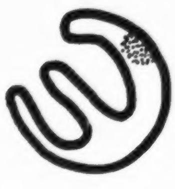

ischemia

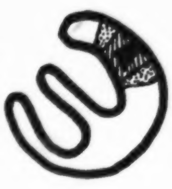

injury

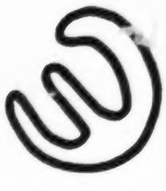

infarction

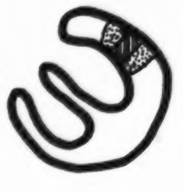
119

Number the diagrams below according to the order in which they might appear.









prevalence
incidence

12

Coronary disease refers to a heart disease related to disorders of the arteries around the heart. This explains why many people use the terms heart disease and____________disease interchangeably.

2nd degree damage or injury will develop

66

Infarction involves muscle death.
Ischemia and injury, on the other hand, do not involve_______ _______.

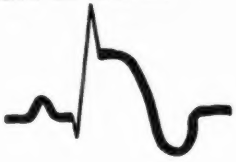
---

2 4 1 3

120

After how much time following occlusion of a blood vessel might one see this pattern?_________

Note: The Q wave is normal.



This pattern is usually indicative of___________.

13

coronary

Coronary disease occurs when the supply of blood reaching the heart through the arteries is reduced. The reduced efficiency of the_________ around the heart is thus synonymous with coronary disease.

67

muscle death

Ischemia is always reversible, while infarction, since it involves______________ ________________ is not. Injury, on the other hand, is usually reversible.

Complete the table below:

Degree	Name	Reversibility
1st		
2nd		
3rd		

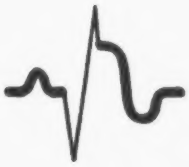
121

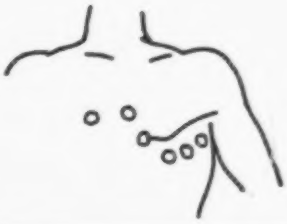
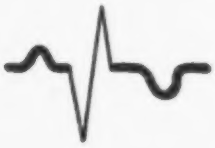
After several minutes
injury

The T wave becomes inverted____________after occlusion.
(when ?)
The S-T segment usually becomes elevated after ______if the occlusion persists. When infarction occurs, the Q wave usually begins to become enlarged several______or_____following occlusion.

arteries	14 When a doctor tells a patient that his arteries are circulating less blood to the heart, the physician is informing him that he is suffering from_______ ___________.
muscle death ischemia:reversible injury:usually reversible infarction:not reversible	68 The electrocardiogram, ECG for short, is an important aid in diagnosing myocardial infarction. Indicate which parts of the word electrocardiogram mean each of the following: electrical __________ heart __________ record __________
Immediately several minutes hours or days	122 The injury pattern generally recedes within three weeks following onset. What would you expect to happen to the S-T segment as the injury pattern recedes? ____

coronary disease or heart disease	15 Sustained stress produces strain on the heart. The strain act on the arteries to__________ the supply of blood reaching the heart, thus producing____________disease.
electrical = electro heart = cardio record = gram	69 An__________________, or _ _ _ for short, is obtained by attaching electrodes to the chest area in front of the heart. The__________pick up the electrical impulses from the heart, and transmit them to the ECG machine via chest leads.
It returns to baseline	123 The_______pattern is generally no longer present after three weeks. The other patterns of damage, namely the________and___________patterns, may remain present for months.

	16
reduce, or decrease, or limit coronary or heart	Stress lasting for brief periods of time is unlikely to produce enough strain on the heart to lead to coronary disease. The risk of coronary disease is, however, increased by strain lasting over_____________periods.
	70
electrocardiogram ECG electrodes	The electrical impulses picked up by the____________ are transmitted to the ECG machine through chest leads. Since recordings are being transmitted from the chest area in front of the heart, known as the precordial area, the terms precordial lead, and_______ _______ are synonymous.
	124
injury ischemia and infarction	After scanning the Q-R and the S-T segments, you might suspect that the patient had an occlusion between________________and________________ago. (how long) (how long) 

long, prolonged, or sustained	17 Coronary attacks are often produced by a sudden overloading of the heart muscles weakened from prolonged coronary disease. Coronary disease, therefore,___________ the risk of a coronary attack.
electrodes chest lead	71 In the diagram below every circle represents an electrode connected to a precordial lead. How many electrodes, connected to__________ ______ are being used?_____ 
Several hours and 3 weeks	125 If the tracing looks like this, the infarction is probably more than________________old. 

		18
increases, raises or magnifies	Overloading of the heart muscles occurs from any sudden excessive demand placed on a heart weakened from prolonged_________ disease. The overloading,then, increases the risk of suffering a coronary____________.	
		72
precordial leads six	All of the ECG tracings in this program are transmitted to the ECG machine via the 5th__________ ______ which is attached opposite the left ventricular wall of the heart. This lead provides diagnostic information about anterior infarctions in the area of the left_______ _____.	
		126
3 weeks	Which must appear first, the inverted T wave, or the enlarged Q wave ?_____ Why?	

coronary or heart attack

A person, unused to heavy exercise, who shovels snow in the winter increases the risk of a__________ ______because of the sudden, excessive stress, or________ing, of the heart muscles.

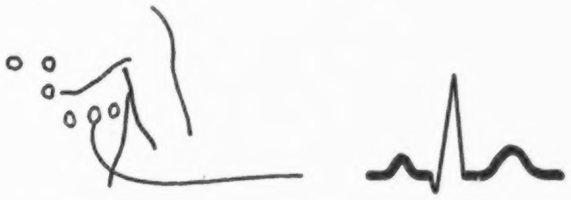
---

precordial lead
or
chest lead

ventricular wall

73

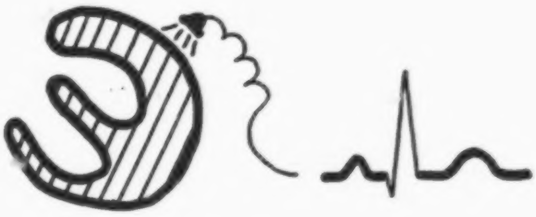
The ECG tracing below is being transmitted via the___ precordial lead. It is attached_______________ (opposite, behind) the____________ __________wall of the heart (left or right) and is useful in the diagnosis of____________________ (anterior or posterior) myocardial infarctions.

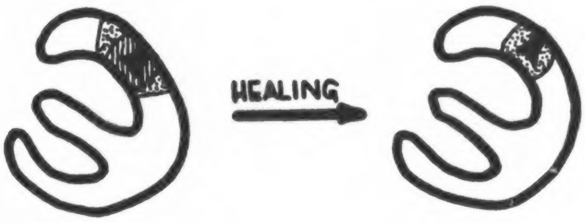


Inverted T
Ischemia precedes infarction.

127

By itself, an________________________ is not necessarily indicative of ischemia.

coronary attack overload(ing)	20 Playing three games of tennis on the first warm Saturday after a year's lay-off_________the heart, and consequently has what effect on the risk of a coronary attack?______________.
5th opposite left ventricular anterior	74 The diagram below shows a normal ECG tracing from the 5th precordial lead which is attached opposite the_____ ____________ _____of the heart. Tracings from this area are useful in the diagnosis of__________myocardial infarctions. 
Inverted T wave	128 In conjunction with an enlarged Q wave, however, an inverted T wave is fairly reliable indication of ___________________accompanied by evidence of ___________________.

overloads raises, increases it	The risk of developing coronary disease increases with any factor which produces prolonged strain on the heart. Chronic tension strains the heart. It follows, therefore, that tension increases the _______of developing coronary disease.
left ventricular wall anterior	75 The electrocardiogram is analyzed in terms of graphic deflections from a baseline. The deflections are labeled P,Q,R,S and T. How many deflections are there?________
Ischemia (myocardial) infarction	129 When the coronary blood supply is restored, the area of____________becomes ischemic, and the formerly ischemic area returns to__________. 

risk

22

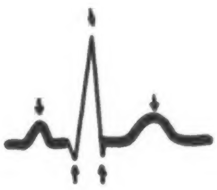
Any factor which places sustained strain on the heart can be called a risk factor; it increases the danger-or risk-of developing coronary disease. Continuous tension could thus be considered a ______factor with respect to coronary disease.

---

five (5)

76

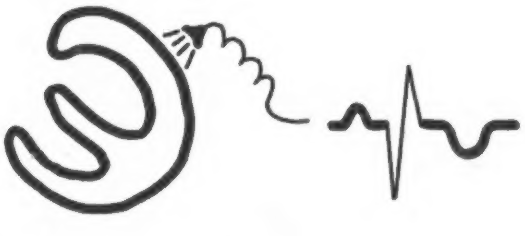
The ECG has five deflections, or waves. Label the five deflections of the normal tracing below using the letters P,Q,R,S,T in that order going from left to right.



Injury
normal

130

What type of damage might this recording be due to?

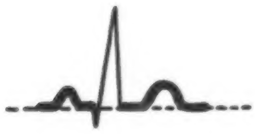


Draw in the appropriate pattern.

risk

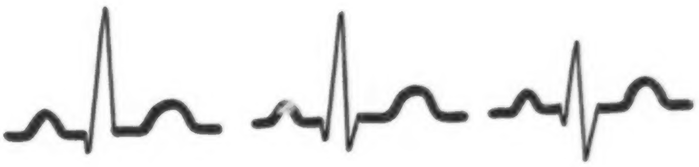
23

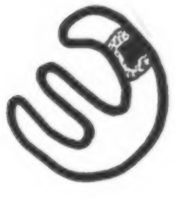
One factor which increases the incidence of coronary disease is cigarette smoking; smoking can, therefore, be considered a_______ _______



77

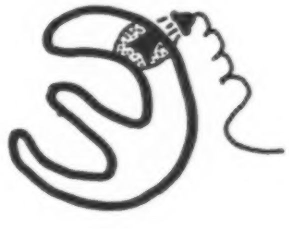
The S deflection is sometimes totally absent. In one of the tracings below the S deflection is absent. Show where it would be if it were present.





131

An old infarction is sometimes surrounded by an area of ischemia. Draw the tracing you would expect to see in such a case.



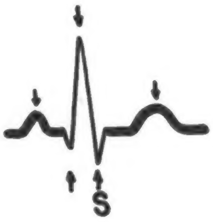
....

risk factor

24

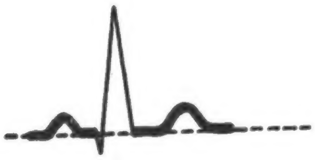
Smoking becomes a risk factor because it constricts the blood vessels and thus reduces the supply of blood reaching the heart. Therefore, sustained smoking is likely to have what kind of an effect on the risk of developing coronary disease?

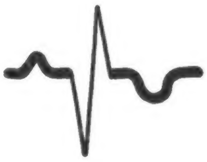
____



78

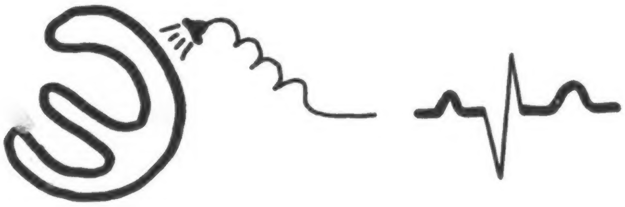
Label this tracing, indicating by arrows which deflection is designated by each letter. Also, show where the S wave would be if it were present.





132

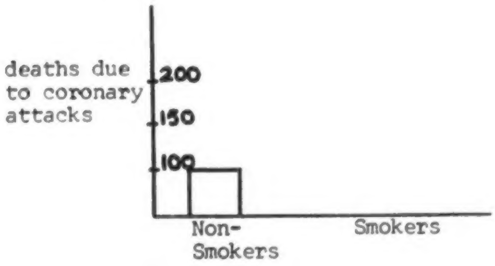
Sometimes, the ischemic and injury areas recover completely. In such a case, what would the damage look like?

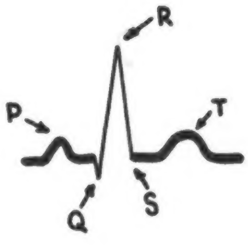


increases it

25

In fact, smokers generally have twice the risk of death from coronary attacks compared to nonsmokers. In the figure below draw the bar to represent the smokers.



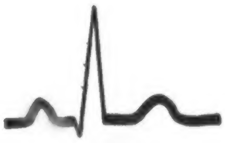


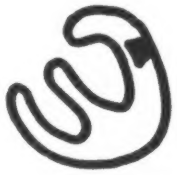
79

In the tracing shown below, the R wave is about

________________________times as large as the Q wave.
(estimate how many times)

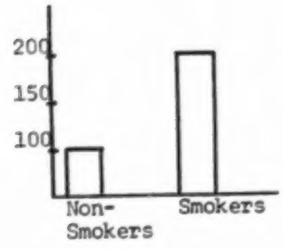
How large is the S wave? ________________________.





133

In some cases even the enlarged Q wave returns almost to normal. This suggests that the__________ area is replaced by a scar which is almost imperceptible by ECG.



26

It has been found, for example, that air pollution produces physical effects similar to those of cigarette smoking.

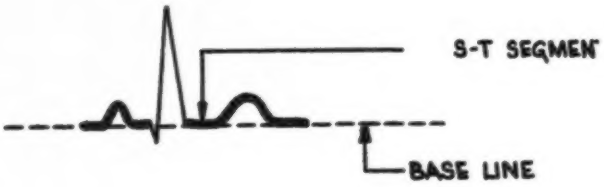
One can, therefore, assume that air pollution is also a______factor with respect to increasing the incidence of __________disease.

---

4 to 6 times as large
The S wave is not present

80

What is the relationship of the S-T segment to the base line? ______________________________.

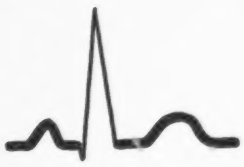
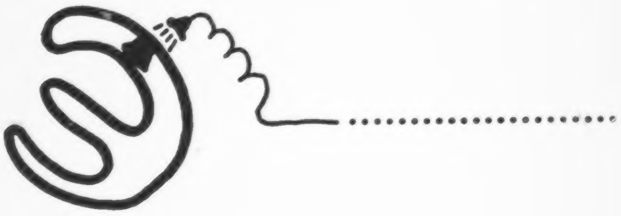


---

infarcted

134

After many months or years, the inverted T wave may become upright again, indicating________________.

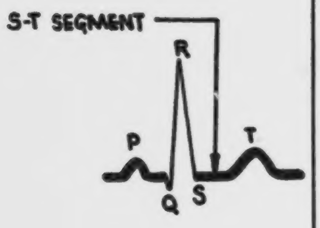
risk coronary, heart	27 Air pollution is caused by pollutants associated with industrialization being trapped in the air. One would, therefore, expect pollution to be greater in urban than in__________areas.
The S-T segment lies on the baseline	81 After labeling the normal tracing below, indicate which is wider, the P-Q segment or the S-T segment. ____________________ 
recovery of the ischemia zone	135 What tracing would describe the healed infarction shown below. 

3

rural, suburban

28

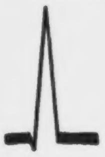
Since rural areas have less air pollution, and air pollution is a risk factor, the prevalence of coronary disease in rural areas is________than it is in urban areas.

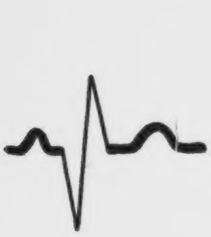


S-T segment is wider

82

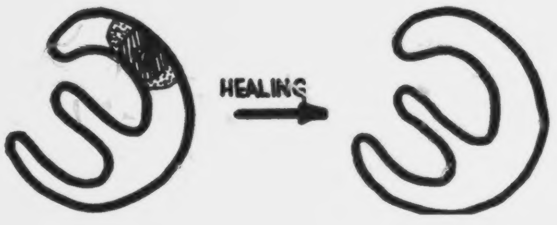
In this diagram, the P and T waves are missing. Draw them in as they would appear in the normal tracing.





136

Assume that healing had taken place. By applying what you know about the reversibility of the three degrees of damage, what would the healed muscle look like in the diagram below?

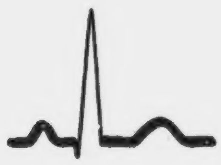


29

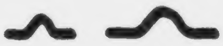
lower, less than, etc.

Fatty substances in the blood or Serum Cholesterol can be a risk factor. People with high concentrations of serum cholesterol should develop coronary disease__________frequently than people with lower levels.

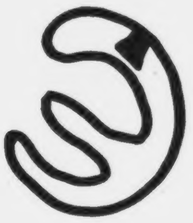
83



The Q, R, and S waves are missing in this diagram. Draw them in as they might appear in the normal electrocardiogram.



137

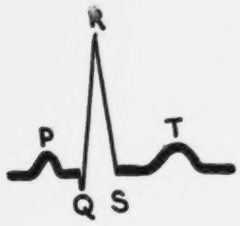


The waves that may remain abnormal even years after the original infarction are the________, the______ and the_______waves.

more, greater, etc.

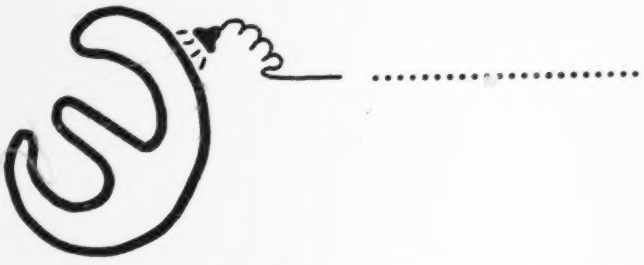
30

A person with a high concentration of fatty substances in his blood, would have a high concentration of_____ _____________in his blood.



84

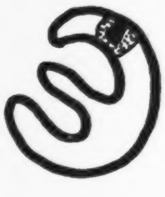
Draw the complete normal ECG tracing with all parts labeled, including the S-T segment.

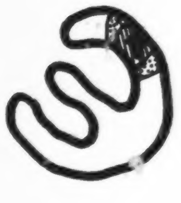


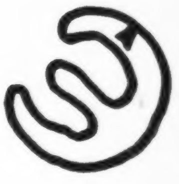
Q, R and T

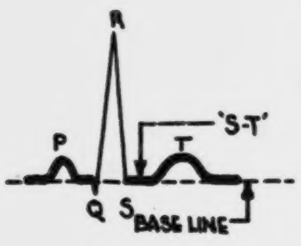
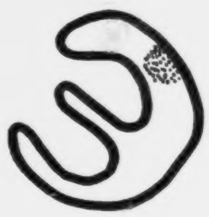
138

Number the diagrams below according to the order in which they would occur during the healing process.





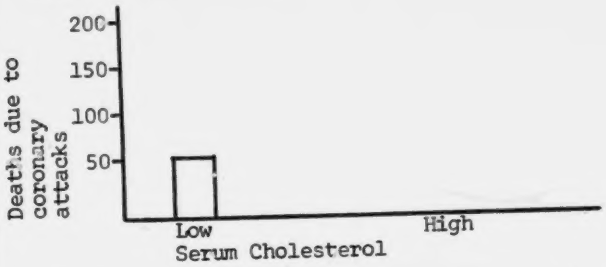


serum cholesterol	31 Since serum cholesterol is a risk factor with respect to coronary disease, one would expect people with high serum cholesterol to have a ________incidence of coronary disease than those with low cholesterol in the blood.
	85 The diagram shows the first stage of damage which results immediately following occlusion of the coronary blood supply. The dotted area represents damage of the________degree, or________. 
2 1 3	139 Each individual type of abnormal tracing, taken by itself could be due to a variety of causes, including heart position, drugs and certain diseases other than myocardial infarction. Therefore, a series of tracings spaced in time, and interpreted in the light of the overall clinical picture is required to establish the diagnosis of________ _________ .

higher, greater, etc.

32

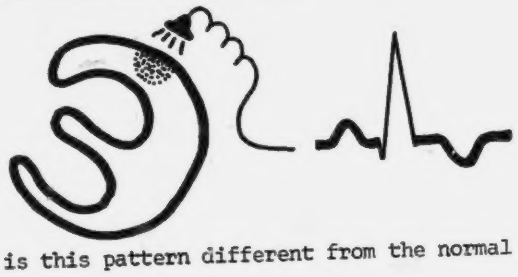
In fact, people with high serum cholesterol concentrations have three times the risk, compared to those with lower concentrations. In the graph below, draw the bar for those with high cholesterol concentrations.



1st degree ischemia

86

The lead opposite an ischemia area will record a pattern which looks like this:



How is this pattern different from the normal pattern?

____

---

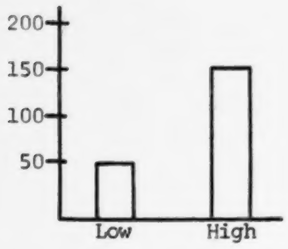
myocardial infarction

140

For a reliable diagnosis of myocardial infarction, serial tracings spaced in time and interpreted in conjunction with the rest of the patient's clinical picture are necessary. Why?

____

____



Serum Cholesterol

33

The greater risk of coronary disease associated with high________ ___________is due to deposits of fatty substances on the walls of the coronary arteries.

The deposits obstruct the flow of blood, and the heart gets____________blood than it ought to.

The T wave is inverted

87

In first degree damage, or___________, which wave is inverted?____

Because any single type of abnormal tracing could be due to a variety of causes.

141

An additional aid to reliable diagnosis is localization of the________________by the use of different electrode placements.

What are two other requirements for a reliable diagnosis?

____

____

serum cholesterol
less

34

A heart which is connected to narrowed coronary arteries is more severely strained than one connected to normal arteries.

If the strain on the heart produced by narrowing is prolonged, that heart becomes __________ vulnerable to overload than it used to be.

---

ischemia
The T wave

88

Draw the ischemia pattern next to the normal pattern.

....

---

damage
1. Serial tracings
2. Interpretation in conjunction with the total clinical picture.

142

What three requirements must be met before the ECG indications can be interpreted as myocardial infarction with reasonable certainty?

____

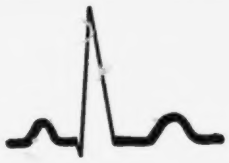
____

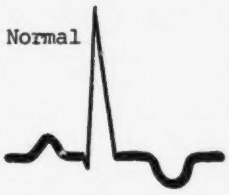
____

more

35

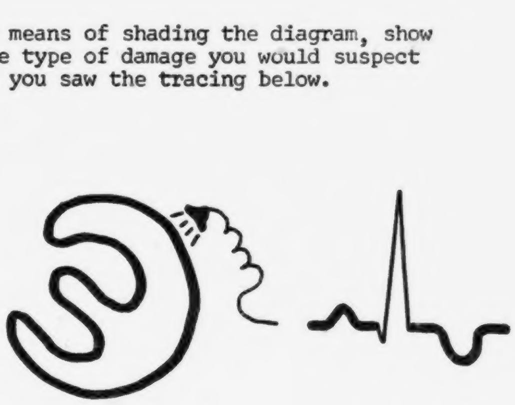
As overload increases, the risk of a sudden coronary__________increases.


Normal


Ischemia

89

By means of shading the diagram, show the type of damage you would suspect if you saw the tracing below.



---

1. Serial tracings
2. Interpretation of the electrocardiogram in conjunction with the total clinical picture.
3. Localization of the damage.

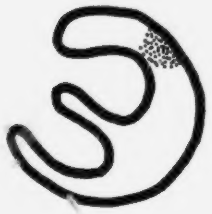
143

______ _________ taken over a period of time (several months) following onset, are also of great help in managing the patient and monitoring the progress of his recovery.

attack

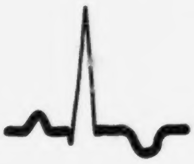
36

We have so far seen that smoking, air pollution, and high concentrations of serum cholesterol are all_______ ________ with respect to coronary disease. The risk of contracting coronary disease when all three factors are present is________ than when fewer factors are present.



90

Within minutes following ischemia, the "injury" pattern appears. Why do you suppose the tracing shown below is rarely seen in clinical practice?



____

serial tracings

risk factors
greater, higher,
more, etc.

37

Tom: Smokes a pack of cigarettes per day, lives on a farm
Dick: Smokes a pack a day, lives in the city, and has high cholesterol
Harry: Does not smoke, lives on a farm.

Who runs the greatest risk of developing some form of heart disease?______________ Who runs the least risk?________________

Because it is only
present for such a
short time.

91

The inverted T wave is not necessarily indicative of ________________________________.

It may have numerous other causes, including pulmonary infarction, myocarditis, pericarditis, ventricular hypertrophy, digitalis, anoxia, electrolyte imbalance, and many others. How many specific alternative causes of inverted T waves are listed above? _______________

Dick
Harry

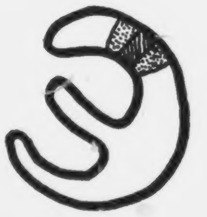
38

As indicated before, the heart becomes vulnerable to overload as a result of strain occurring over____________years.
(few, many)

ischemia
seven

92

The cross hatched area represents 2nd degree damage. Label each area with the name of the damage.



39

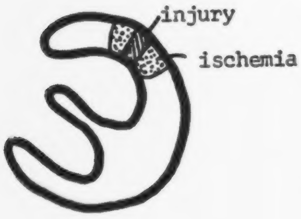
many

The various risk factors have operated longer on old people than young people, therefore, age itself is likely to be an important________
________.

---

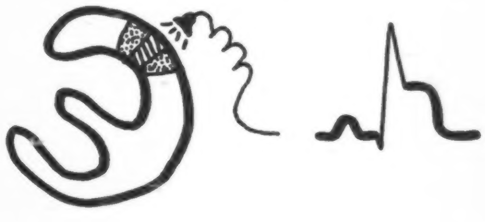
cross hatched: injury

dotted: ischemia



93

The pattern recorded from an injury looks like this:



How is this tracing different from a normal tracing?
____.

	40
risk factor	The number of new cases of coronary disease, technically defined as the__________, is about 3 per 1000 at age 40 20 per 1000 at age 60 The incidence at 60 is about ___ times as high as at 40.
	94
The S-T segment is elevated	In__________________________, the S-T segment is elevated while in______________________the T wave is inverted.

incidence
6, 6½, 7

41

Age	Fatalities due to Coronary Disorder
25-29	378
45-49	16,672
65-69	71,406

These data suggest that an appropriate generalization for the relationship between age and coronary fatalities is that as one increases the other one __________.

---

injury
ischemia

95

Draw an injury tracing next to a normal tracing.

....

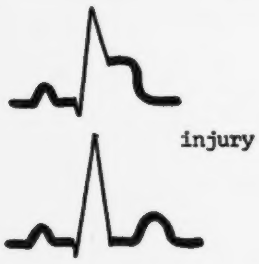
increases

42

Incidence of Coronary Fatalities by Age and Sex

Age	Men	Women
25-29	285	93
45-49	13,785	2,887
65-69	47,378	24,028

The data above lead to the generalization that men________________________________.

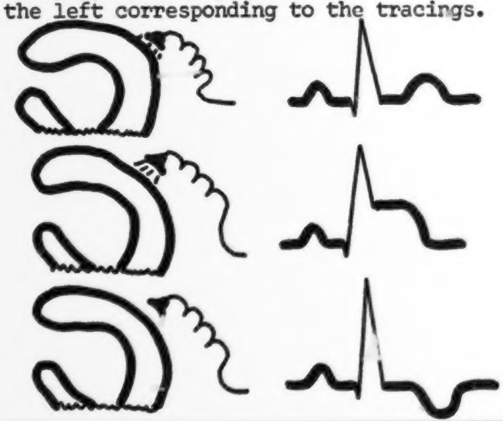


injury

normal

96

Draw appropriately shaded areas into the myocardia on the left corresponding to the tracings.



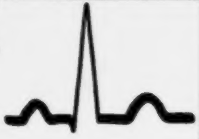
Any phrase implying that: men have a higher incidence of fatalities than women

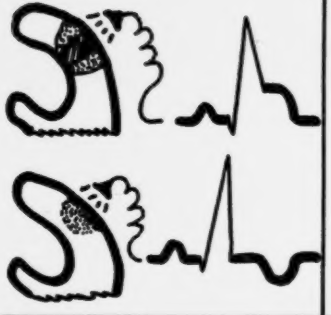
43

Another risk factor with respect to developing coronary disease is occupation. This implies that people in some occupations run a greater ______ of developing coronary disorder than people in other ____________s.

---

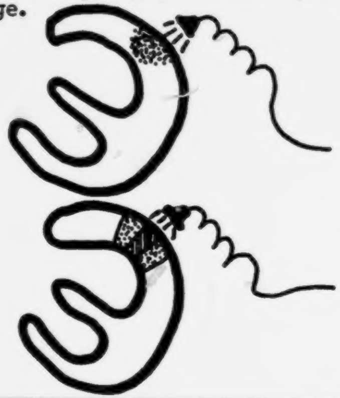
normal





97

For each lead, draw the type of recording which might be obtained, together with the name for the type of damage.



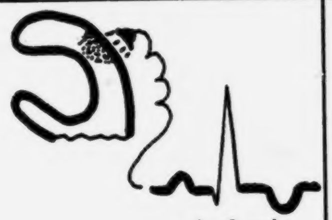
....

....

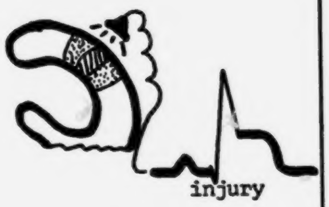
risk
occupations

44

Professional people work under greater stress than people in other occupations. One would, therefore, expect them to run a greater__________of coronary disease than people in other occupational groups.



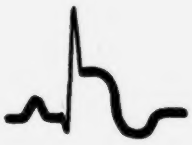
ischemia



injury

98

The tracing shown below combines the patterns characteristic of two types of damage. What are they?



______________________ ______________________

45

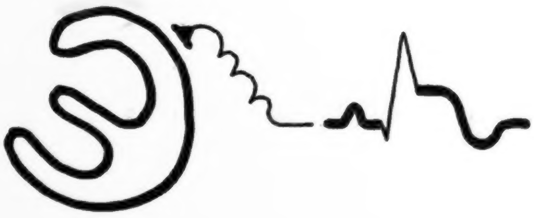
risk

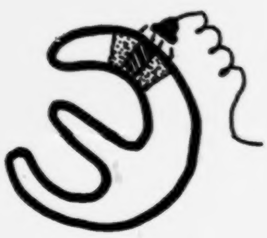
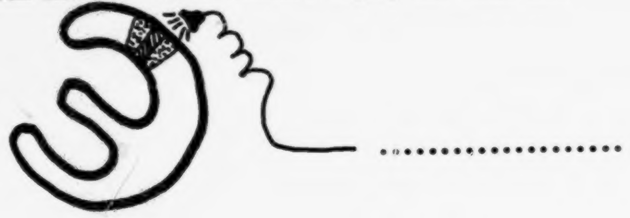
Lack of physical activity is another risk factor. People who engage in limited physical activity run a________ risk of coronary disorder than those who engage in a great deal of________ ________.

99

ischemia
injury

Indicate by shading the nature of the damage that could produce the tracing shown.



greater physical activity, or exercise	46 Another risk factor is anxiety. People with a lot of anxiety are more likely to develop coronary disorder that people with__________ __________.
	100 Draw the tracing that might be obtained by recording from an area which combines injury and ischemia. 

low anxiety, less annxiety, without anxiety

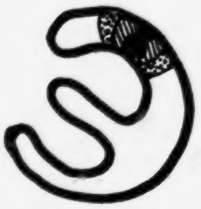
47

Since professional people engage in less physical exercise than people in other occupational groups and are more prone to anxiety it is not surprising that the incidence of coronary disorder among them is__________than it is among people in other occupatioanl groups.

101

Speaking technically, the longer the__________of the blood supply in the affected area, the___________ the severity of damage, ending with what is called

___________ ___________.

higher, greater	48 High blood pressure indicates that the heart is working harder than normal in distributing blood through the body. If high blood pressure persists, we would expect it to become a__________factor in the occurrence of coronary disorder.
occlusion greater myocardial infarction	102 The blackened area represents dead myocardium, and the surrounding areas decreasing severity of damage. Label the areas by the names for the three degrees of damage. 

risk

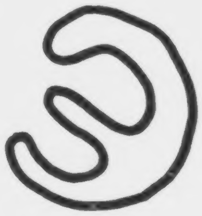
49

High blood pressure, if prolonged,makes the arteries around the heart hard and narrowed. Consequently, the_______has to work harder to pump blood and thereby becomes enlarged.

infarction = black
injury = hatched
ischemia = dotted

103

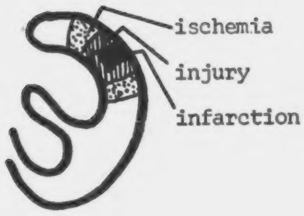
Show how myocardial damage could be represented in this diagram. Shade and label the three degrees of damage.



heart

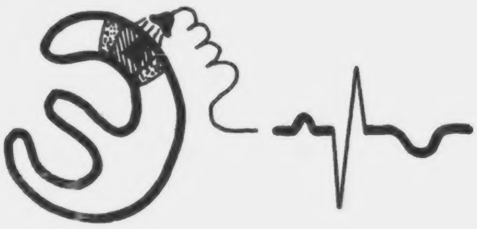
50

As a result of prolonged high blood__________, the enlarged________is less and less able to provide itself with a sufficient blood supply.


ischemia
injury
infarction

104

The tracing shown below is from an infarcted area. How does this differ from the normal pattern?



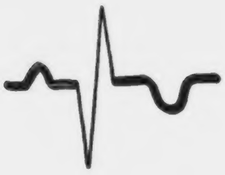
pressure heart	51 In addition to narrowing the arteries, high blood pressure makes the enlarged heart less and less able to provide enough_________for itself.
The Q wave is enlarged and the **R** wave is shorter. The T wave is inverted.	105 A shortened R wave has the same significance as an enlarged Q wave namely_________________________.

blood	52 The heart of an individual who has had high blood pressure for many years would, therefore, be_______able to cope with a sudden demand than the heart of an individual with low blood pressure.
infarction	106 Draw a tracing from an infarcted area. ....

less

53

As indicated previously, the greater the number of risk factors operating, the higher the risk of a__________attack.



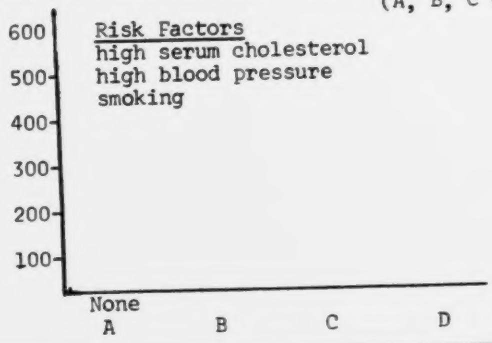
107

An enlarged Q wave and shortened R wave are indicative of__________ __________. These waves are irreversible because______ ______ ___ ______.

coronary or heart

54

In the figure below, indicate which bar represents the coronary cases due to the greatest number of risk factors.__________
(A, B, C or D)



Go back to Page 1
for the next frame

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myocardial infarction
Any phrase meaning muscle death has occurred.

108

In general, the larger the Q wave, the shorter the R wave. In each of the diagrams below, draw in the proper size R wave.

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for the next frame